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Atlas of Infrared Absorption Lines

Jae H. Park

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Atlas of Infrared Absorption Lines

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Prepared for
Langley Research Center
under Contract NSG-1203

National Aeronautics
and Space Administration

Scientific and Technical
Information Office

1977

This is a revised edition of the Atlas of Infrared Absorption Lines, NASA CR-144976. Three absorption bands, HNO_3 ($2\nu_9$) and CH_3Cl (ν_4 and $3\nu_6$) are added in this edition. Infrared absorption line strength (atm $^{-1}$ cm^{-2}) vs. line position (cm^{-1}) at 300 ^{o}K for 15 gases are shown in Fig. 1-65 from 500 cm^{-1} to 7,000 cm^{-1}. The absorption bands for each gas shown in the atlas including sources of data are summarized in Table I.

This atlas was found to be useful for feasibility studies of remote sensing of atmospheric pollutants and for the identification of gases in atmospheric absorption spectra. The author hopes that this atlas will provide for those working in the field of infrared spectroscopy a quick guide to obtaining information on (1) what gases contribute to energy absorption in spectral regions of interest and (2) their relative strengths in absorption. Special attention should be given to the scale of line strength. The lines are grouped into intervals of 100 cm^{-1} and only those lines with a strength within 10^{-5} of the maximum value are shown in each interval. Therefore, sudden changes appear in the scales from one interval to another. More absorption line parameters will be added as they become available, and an updated atlas will be released upon request in the future.

Table I. Band centers and sources of data shown in the atlas.

Gas	Band	(cm^{-1})	(μ)	Source of Data
H_2O	ν_2	(1595)	(6.27)	McClatchey et al. (1973)
	ν_1	(3657)	(2.73)	McClatchey et al. (1973)
	ν_3	(3756)	(2.66)	McClatchey et al. (1973)
CO_2	ν_2	(677)	(15.0)	McClatchey et al. (1973)
	ν_3	(2349)	(4.26)	McClatchey et al. (1973)
O_3	ν_2	(701)	(14.3)	McClatchey et al. (1973)
	ν_3	(1042)	(9.60)	McClatchey et al. (1973)
	ν_1	(1103)	(9.07)	McClatchey et al. (1973)
N_2O	ν_2	(589)	(17.0)	McClatchey et al. (1973)
	ν_1	(1285)	(7.78)	McClatchey et al. (1973)
	ν_3	(2224)	(4.50)	McClatchey et al. (1973)
CO	1-0	(2145)	(4.66)	McClatchey et al. (1973)
	2-0	(4260)	(2.35)	McClatchey et al. (1973)
	3-0	(6350)	(1.57)	McClatchey et al. (1973)
CH_4	ν_4	(1306)	(7.66)	McClatchey et al. (1973)
	ν_2	(1534)	(6.52)	McClatchey et al. (1973)
	ν_3	(3019)	(3.31)	McClatchey et al. (1973)
O_2	0-1 ($^1\Delta$-$^3\Sigma$)	(6325)	(1.58)	McClatchey et al. (1973)
SO_2	ν_2	(518)	(19.30)	Calfee (1973, unpublished)
	ν_1	(1151)	(8.69)	Calfee (1973, unpublished)
	ν_3	(1362)	(7.34)	Calfee (1973, unpublished)
NO	1-0	(1876)	(5.33)	Abels and Shaw (1966)
NO_2	ν_3	(1621)	(6.17)	Goldman et al. (1975)
	$\nu_1 + \nu_3$	(2910)	(3.44)	Goldman (1975, private)
NH_3	ν_2	(933)	(10.70)	Taylor (1973)
HCl	1-0	(2886)	(3.46)	Benedict et al. (1956) and
	2-0	(5668)	(1.76)	Toth et al. (1970)
HF	1-0	(3962)	(2.52)	Goldman et al. (1974)
HNO_3	$2\nu_9$	(896)	(11.16)	Brockman (1977, private)
CH_3Cl	ν_4	(3039)	(3.29)	Margolis (1977, private)
	$3\nu_6$	(3042)	(3.29)	Margolis (1977, private)

NOTE: The combination bands taken from McClatchey et al. (1973) are not listed in this table although the data are plotted.

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J. Mol. Spect., vol. 35, 110-126.

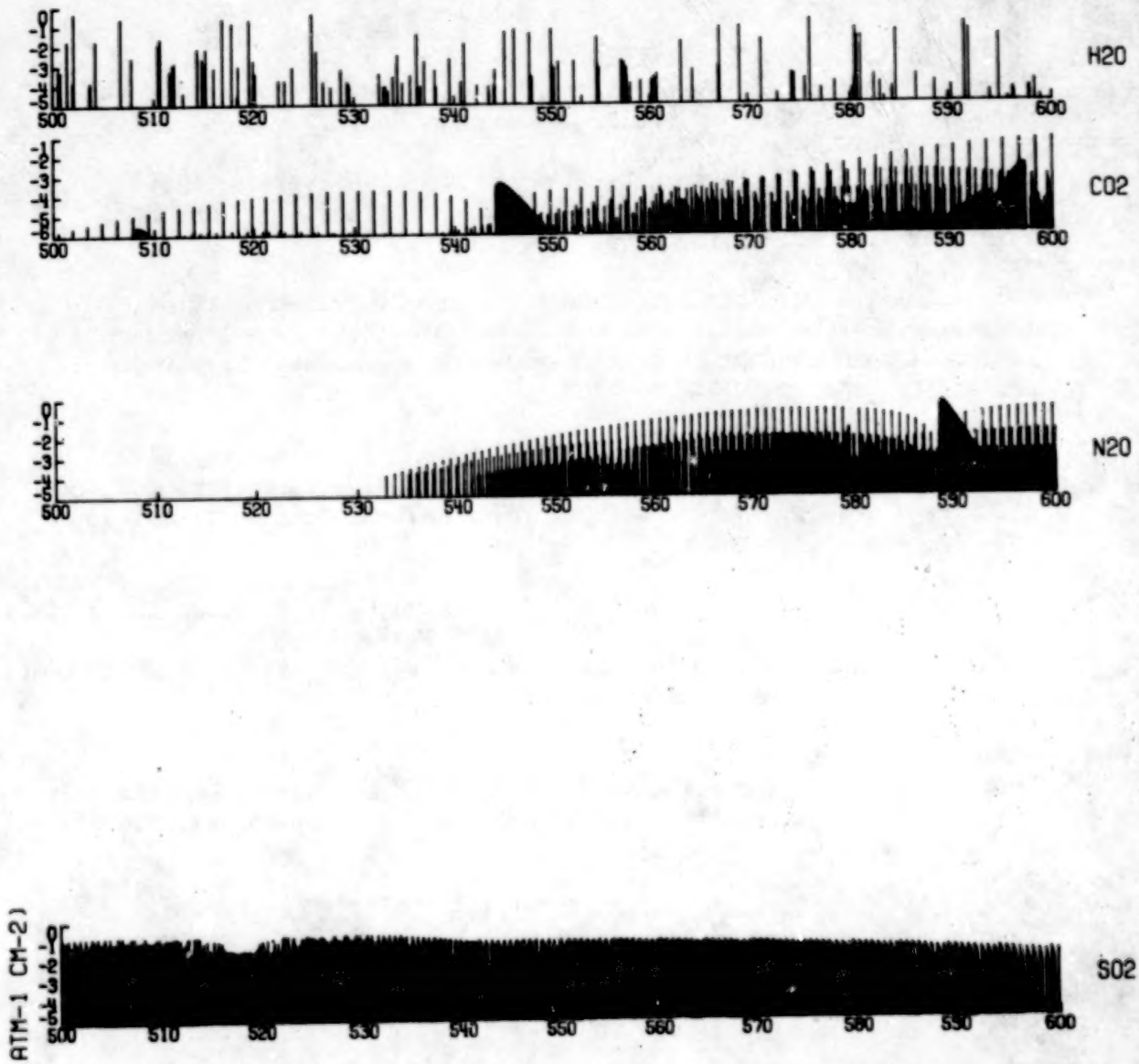


FIG.1 . LINE STRENGTH VS. WAVENUMBER (500 AND 600 CM-1. 20.00- 16.66 MICRON)

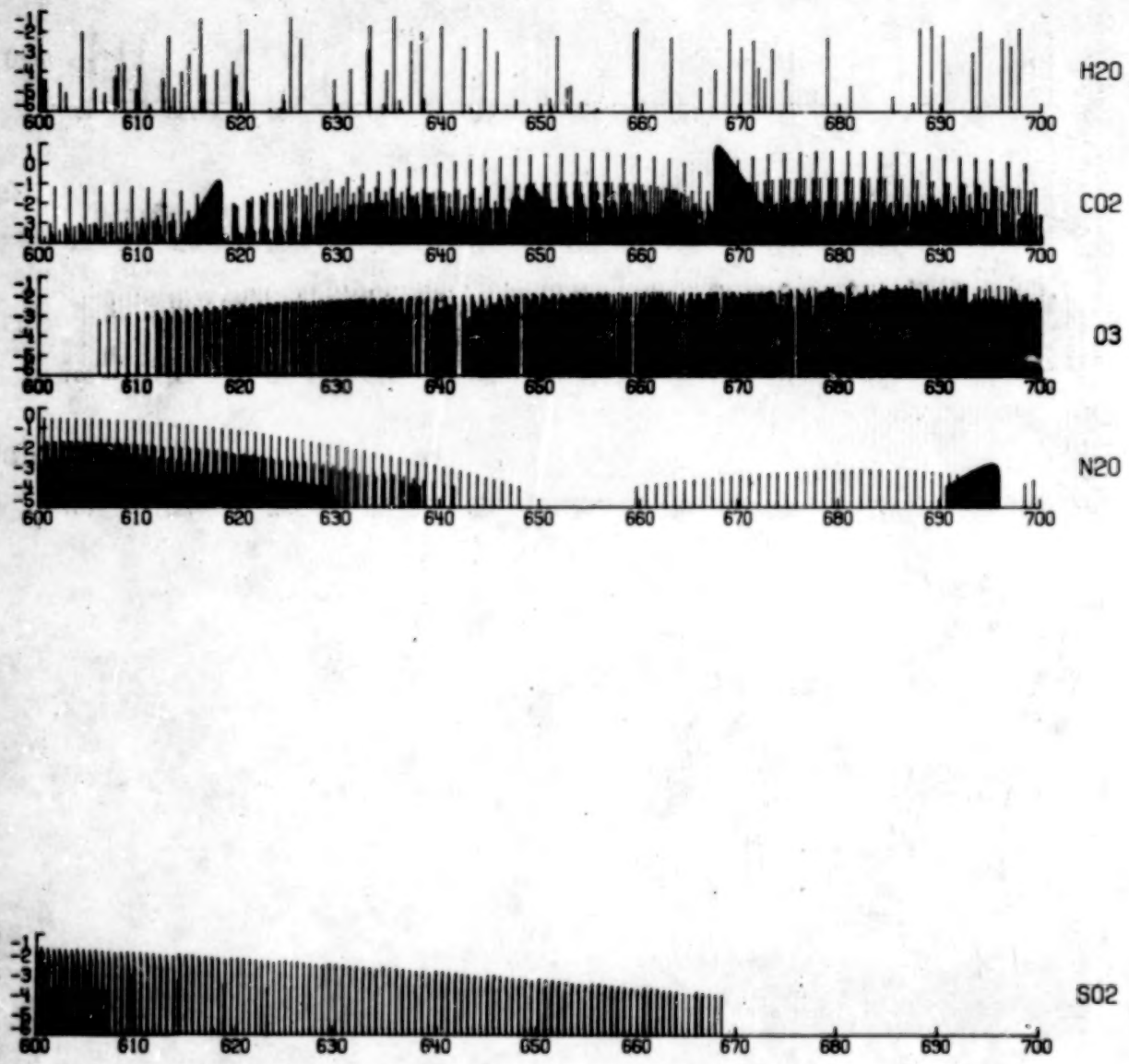


FIG.2 . LINE STRENGTH VS. WAVENUMBER (600 AND 700 CM-1, 16.66- 14.28 MICRON)

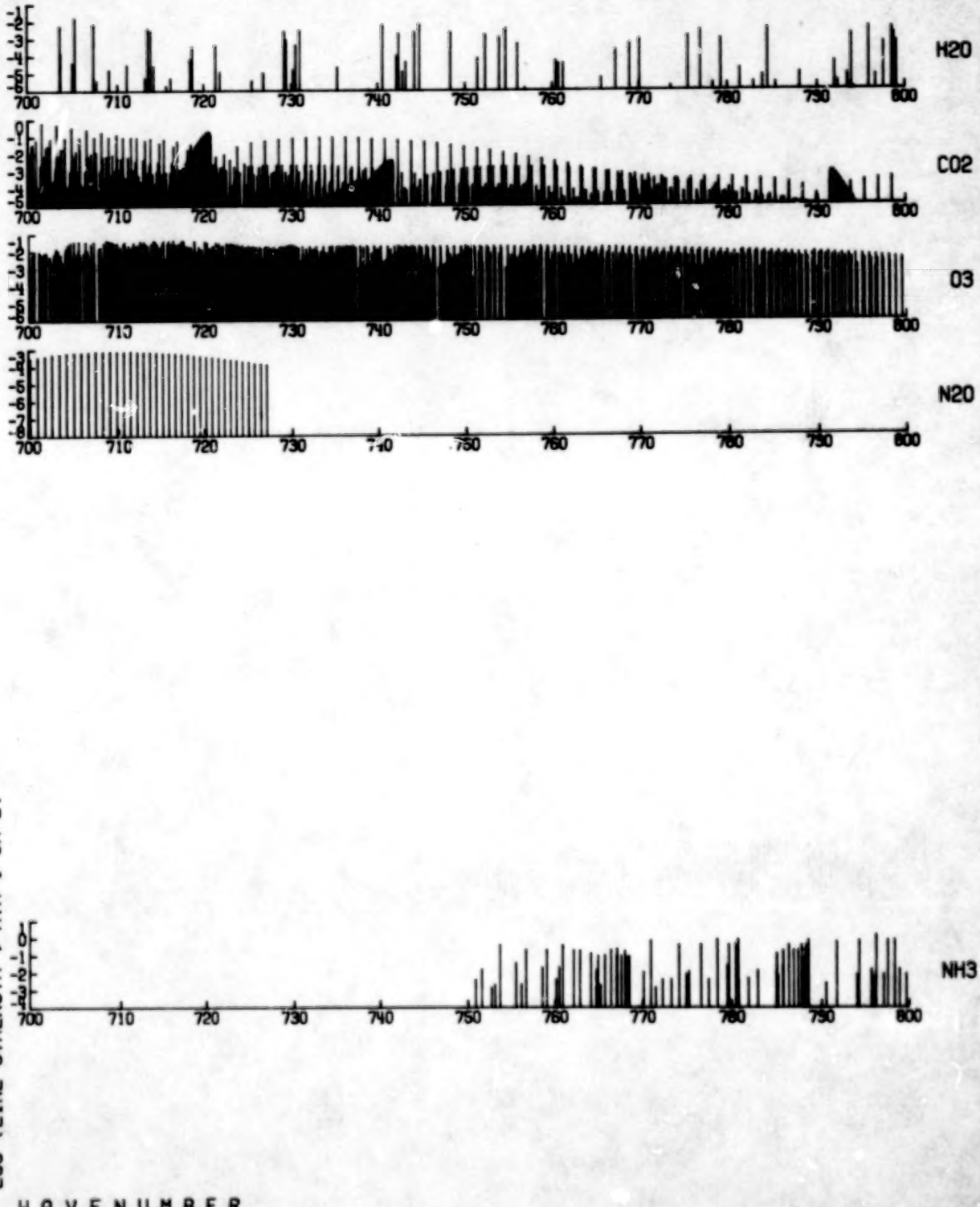


FIG.3 . LINE STRENGTH VS. WAVENUMBER (700 AND 800 CM-1, 14.28- 14.50 MICRON)

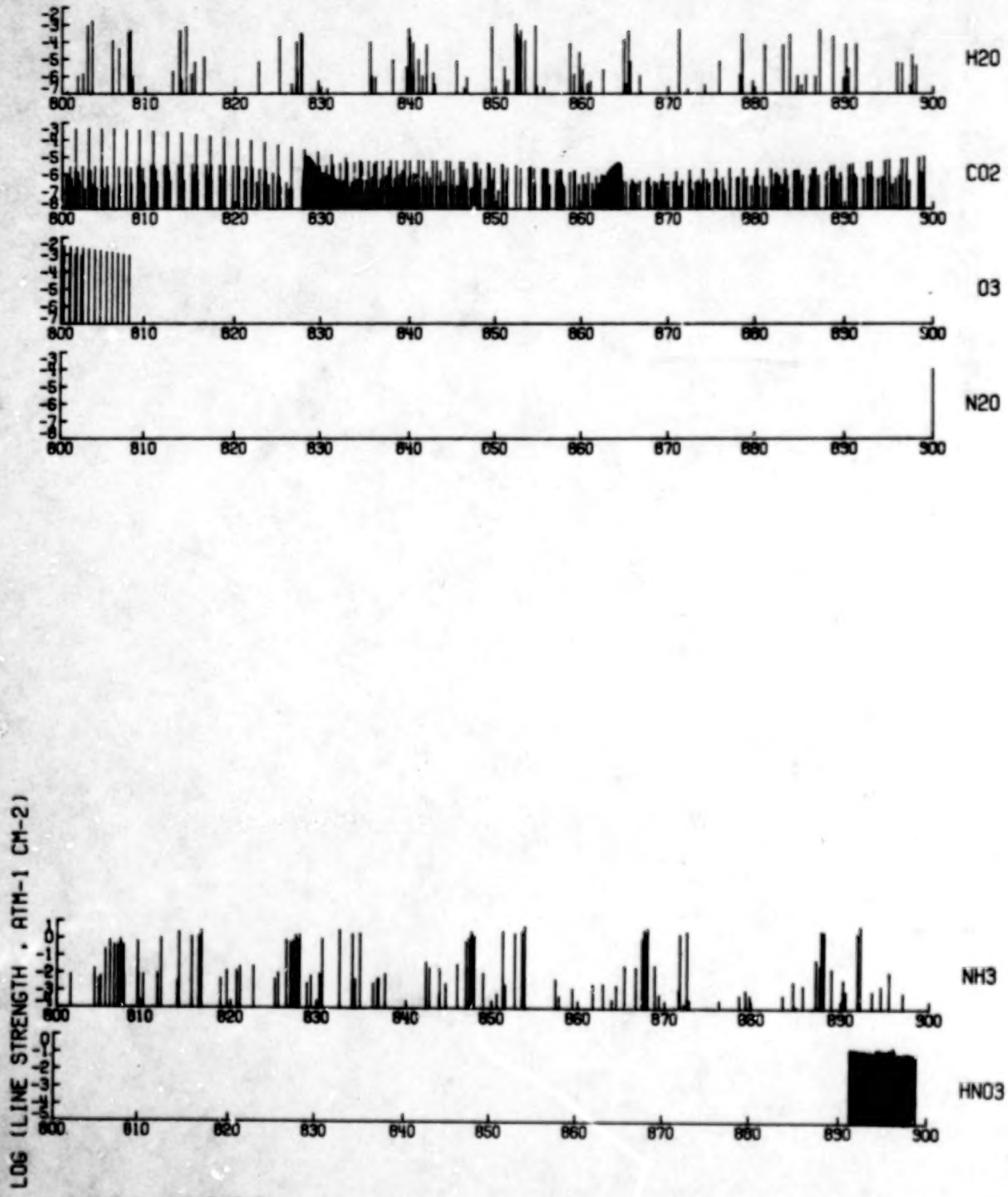


FIG.4 . LINE STRENGTH VS. WAVENUMBER (800 AND 900 CM-1. 12.50- 11.11 MICRON)

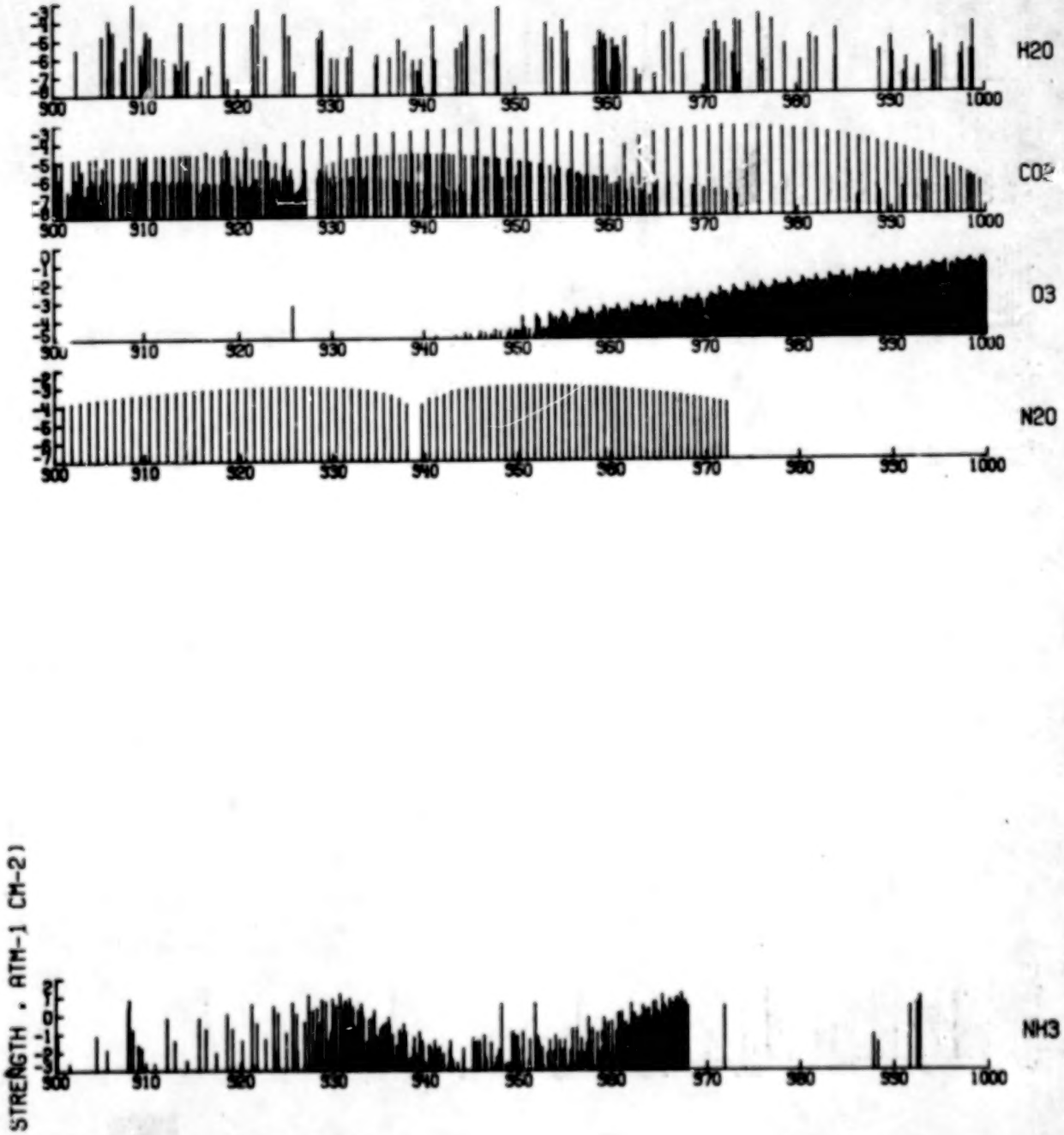


FIG.5 . LINE STRENGTH VS. WAVENUMBER (900 AND 1000 CM-1. 11.11- 10.00 MICRON)

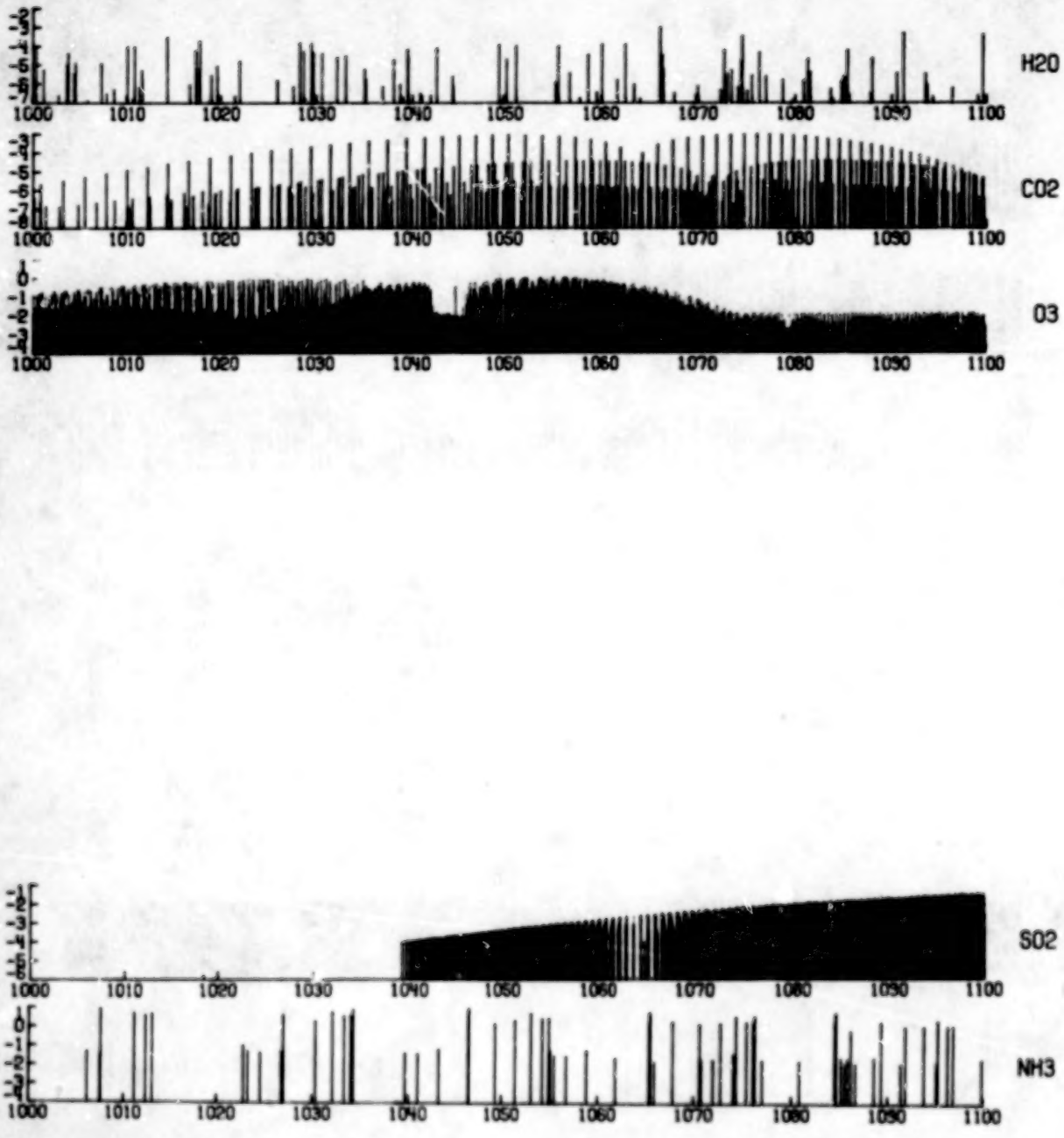


FIG.6 . LINE STRENGTH VS. WAVENUMBER (1000 AND 1100 CM-1, 10.00- 9.09 MICRON)

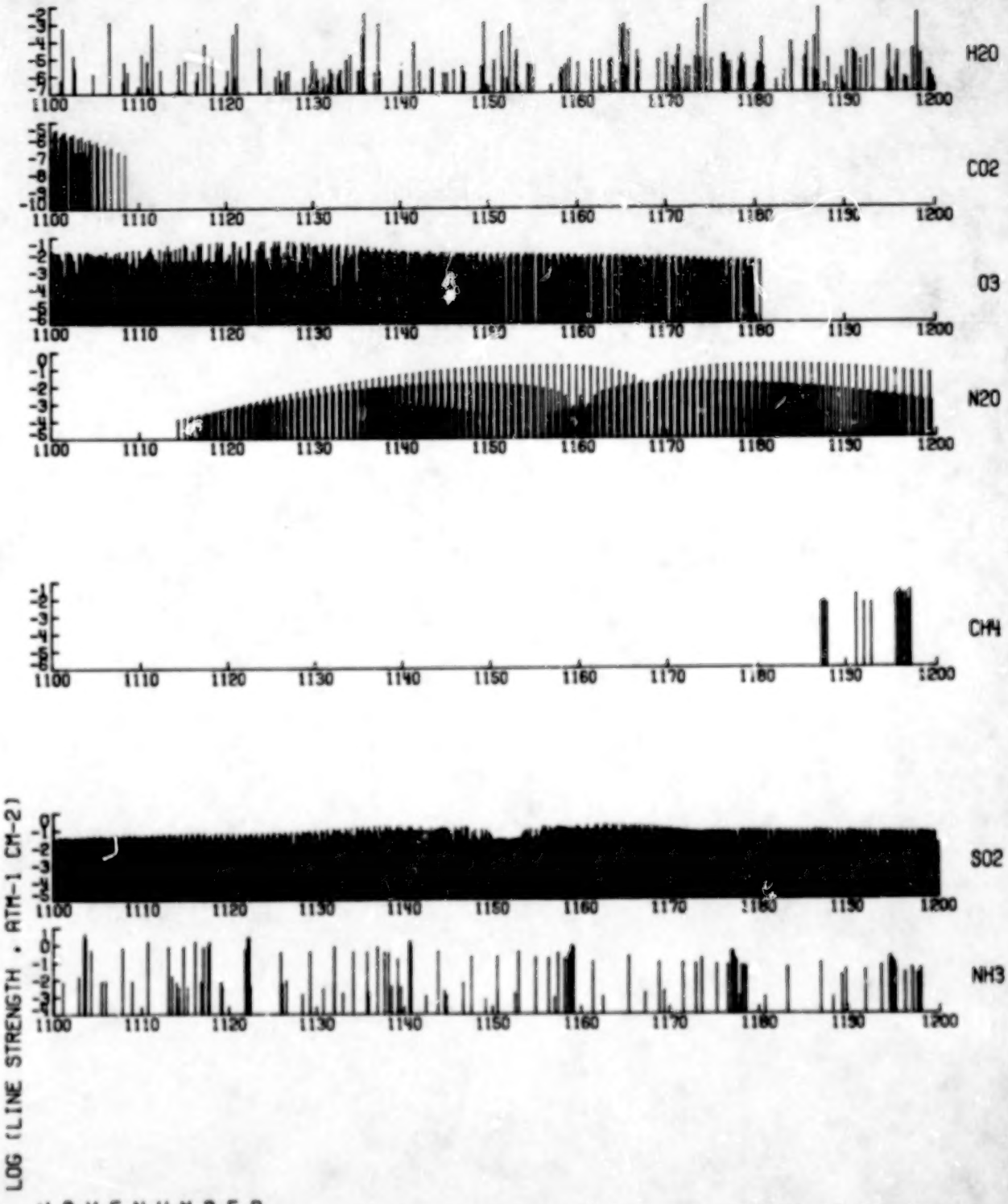


FIG.7 . LINE STRENGTH VS. WAVENUMBER (1100 AND 1200 CM-1, 9.09 - 8.33 MICRON)

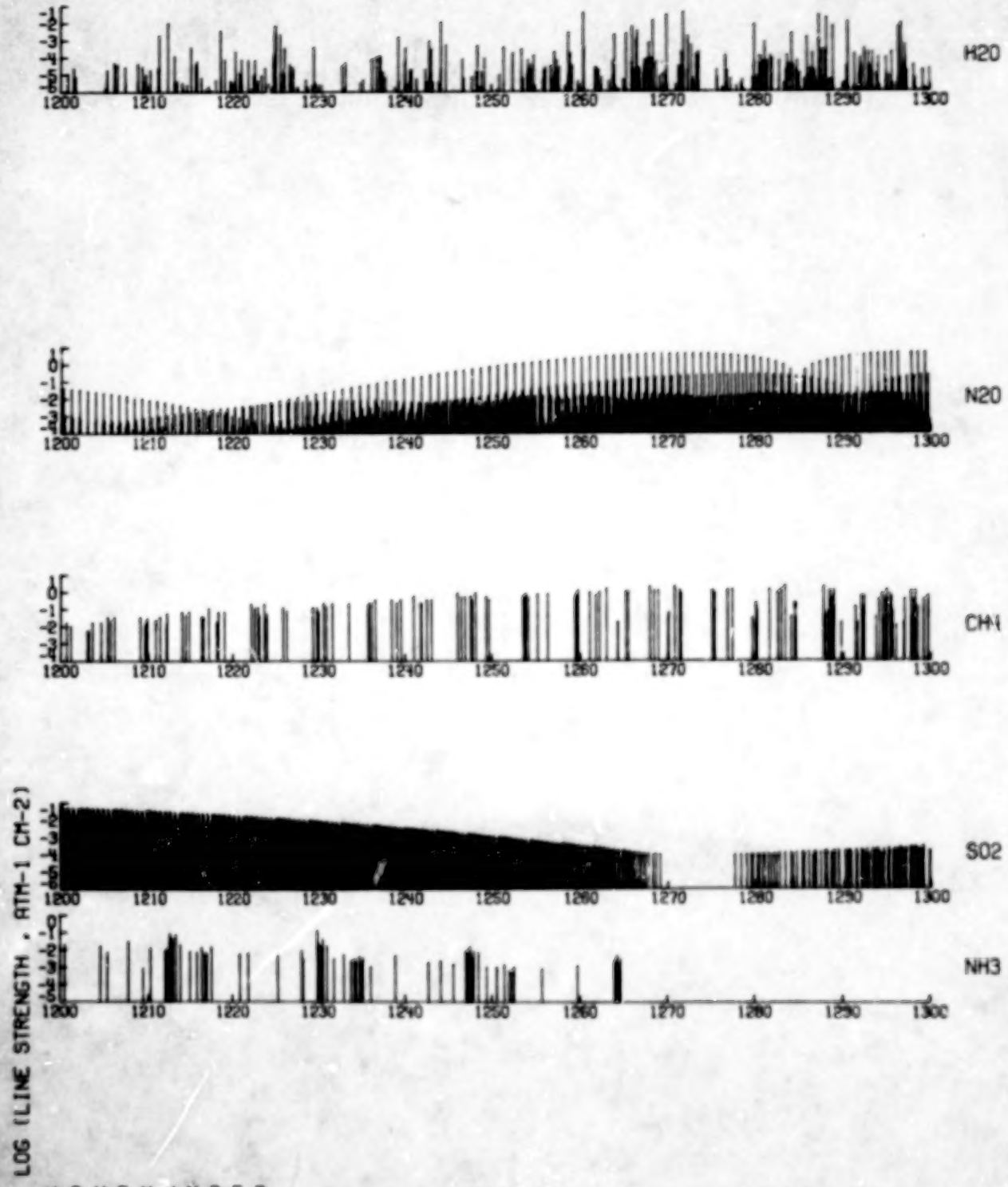


FIG.8 . LINE STRENGTH VS. WAVENUMBER (1200 AND 1300 CM-1, 8.33 - 7.69 MICRON)

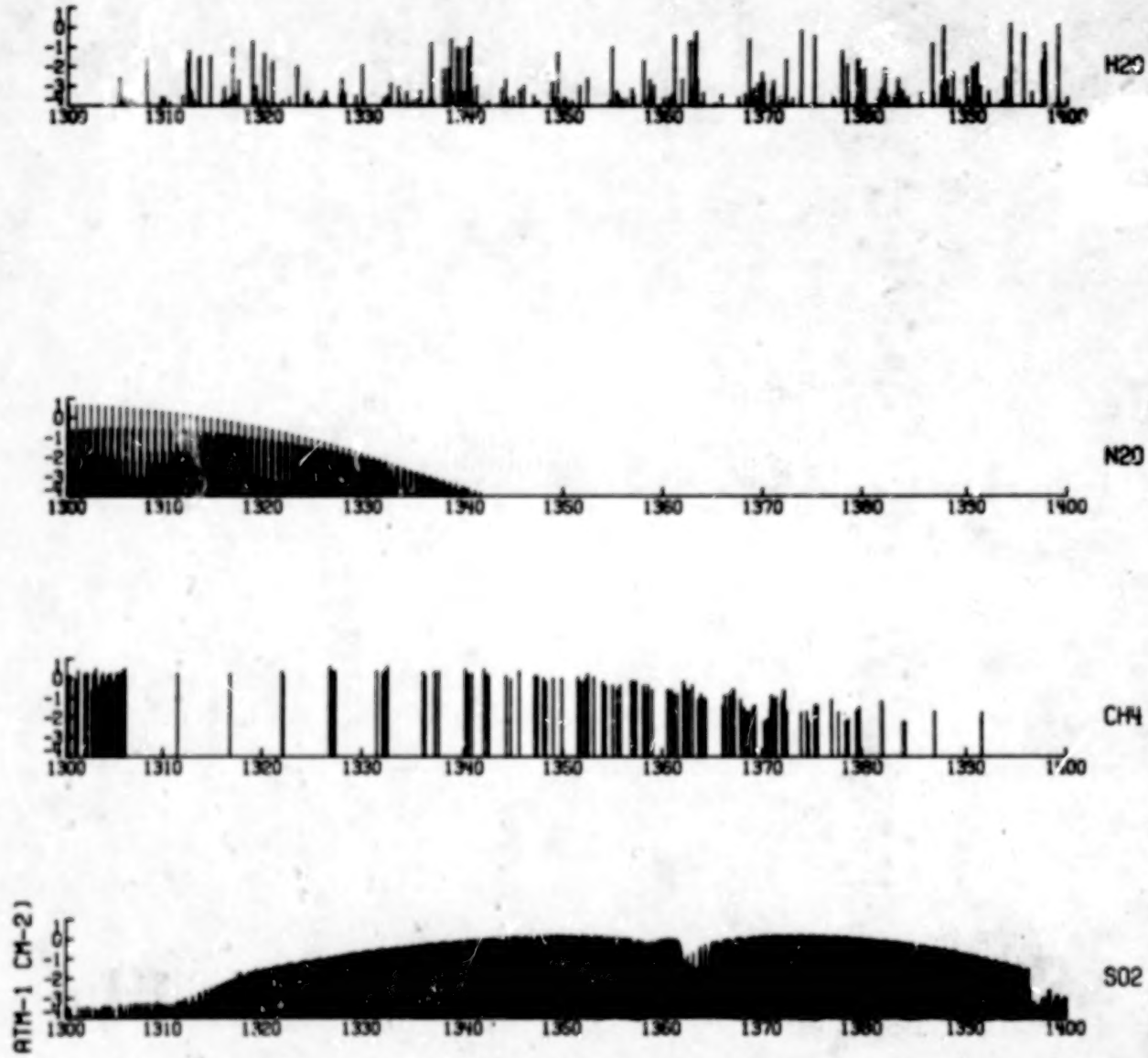


FIG.9 . LINE STRENGTH VS. WAVENUMBER (1300 AND 1400 CM-1. 7.69 - 7.14 MICRON)

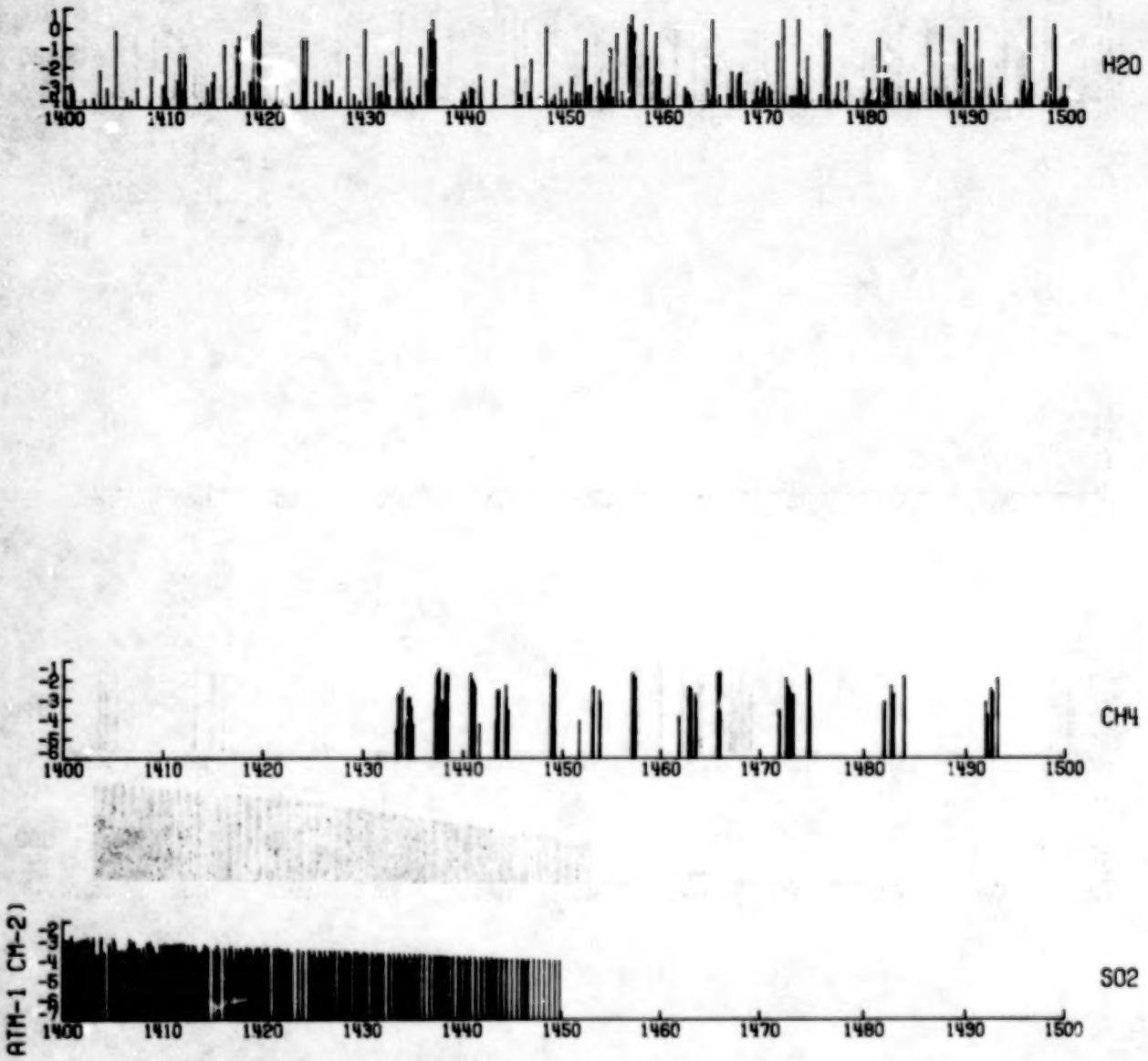


FIG.10. LINE STRENGTH VS. WAVENUMBER (1400 AND 1500 CM-1, 7.14 - 6.66 MICRON)

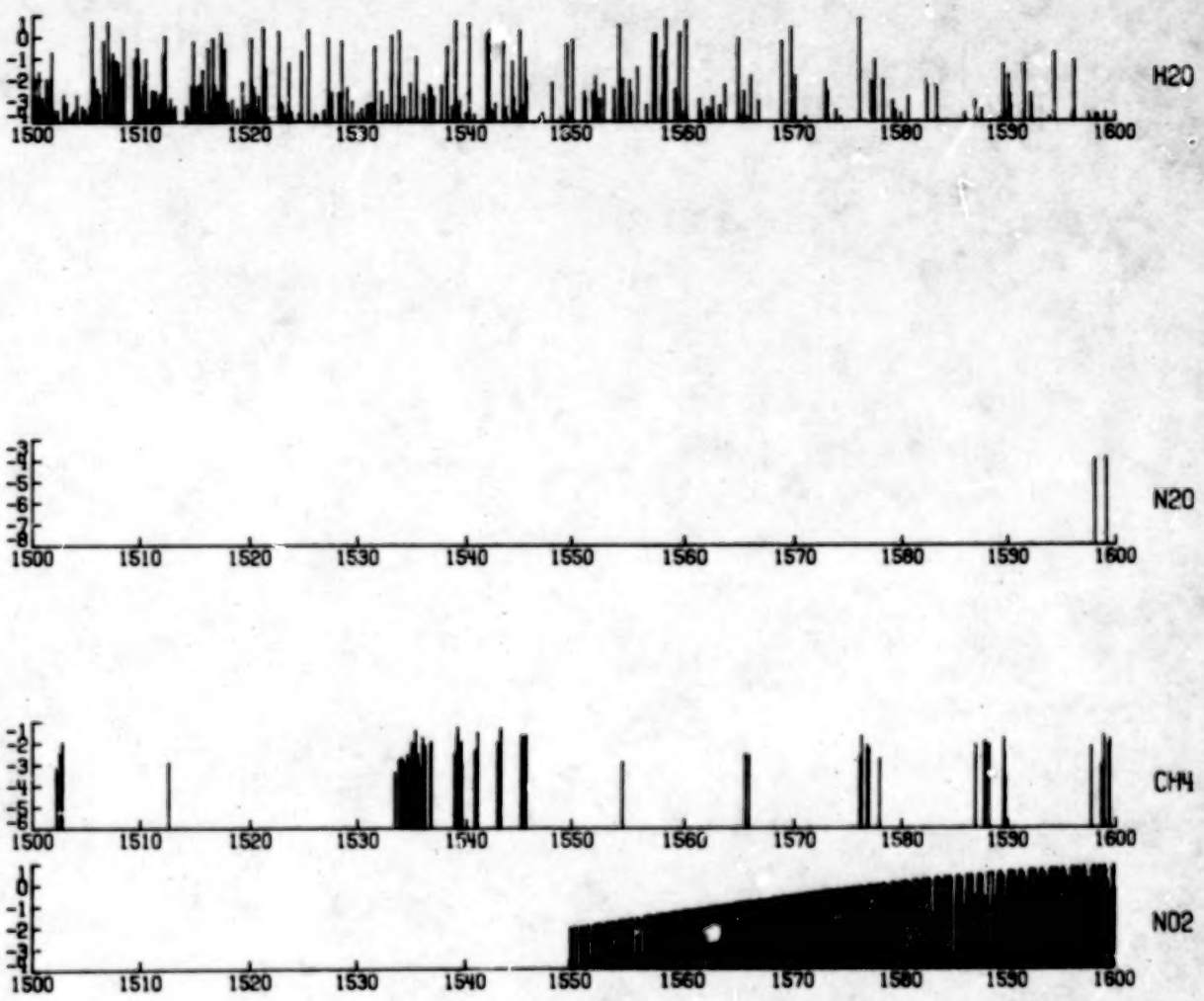


FIG.11. LINE STRENGTH VS. WAVENUMBER (1500 AND 1600 CM-1. 6.66 - 6.25 MICRON)

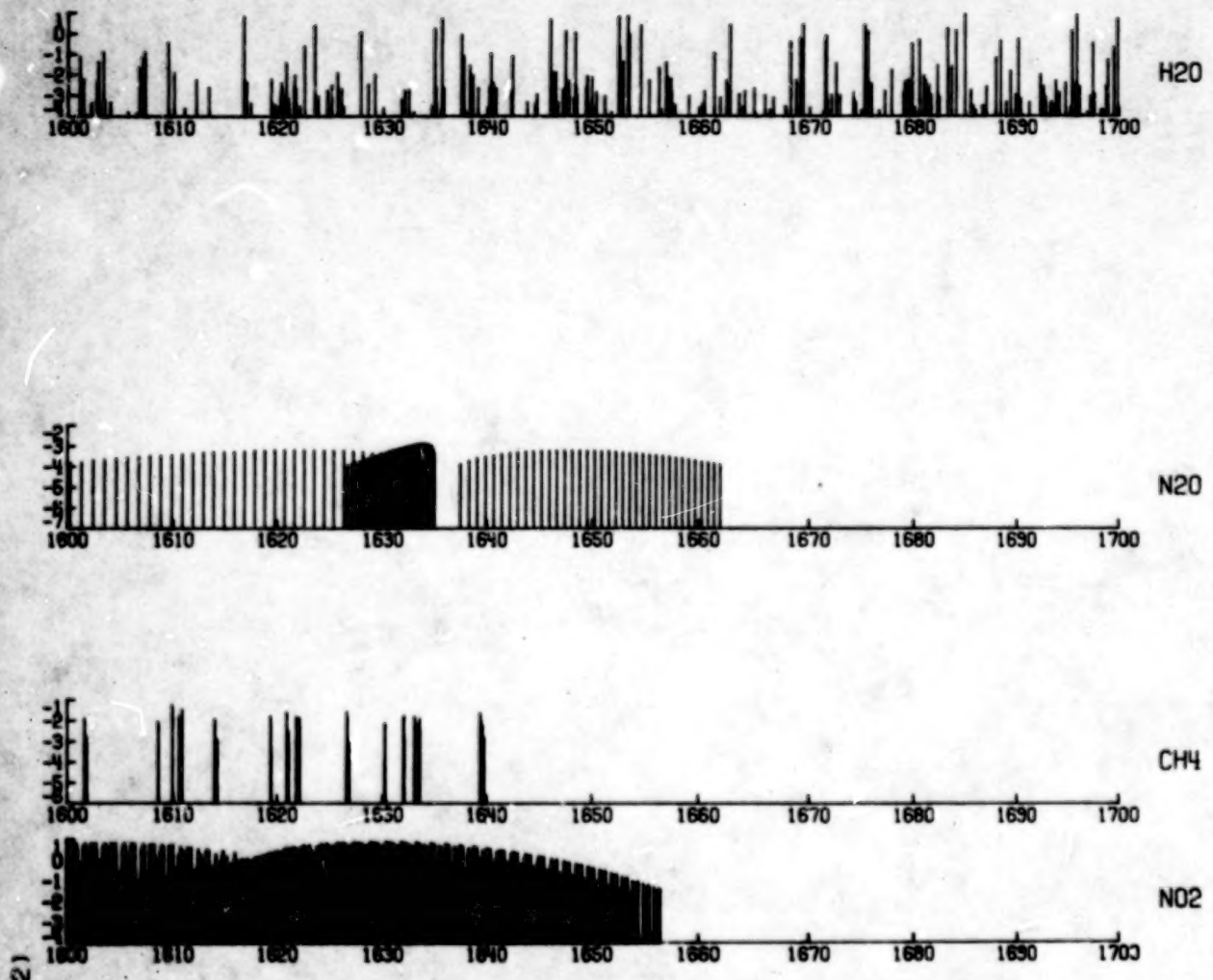


FIG.12. LINE STRENGTH VS. WAVENUMBER (1600 AND 1700 CM-1, 6.25 - 5.88 MICRON)

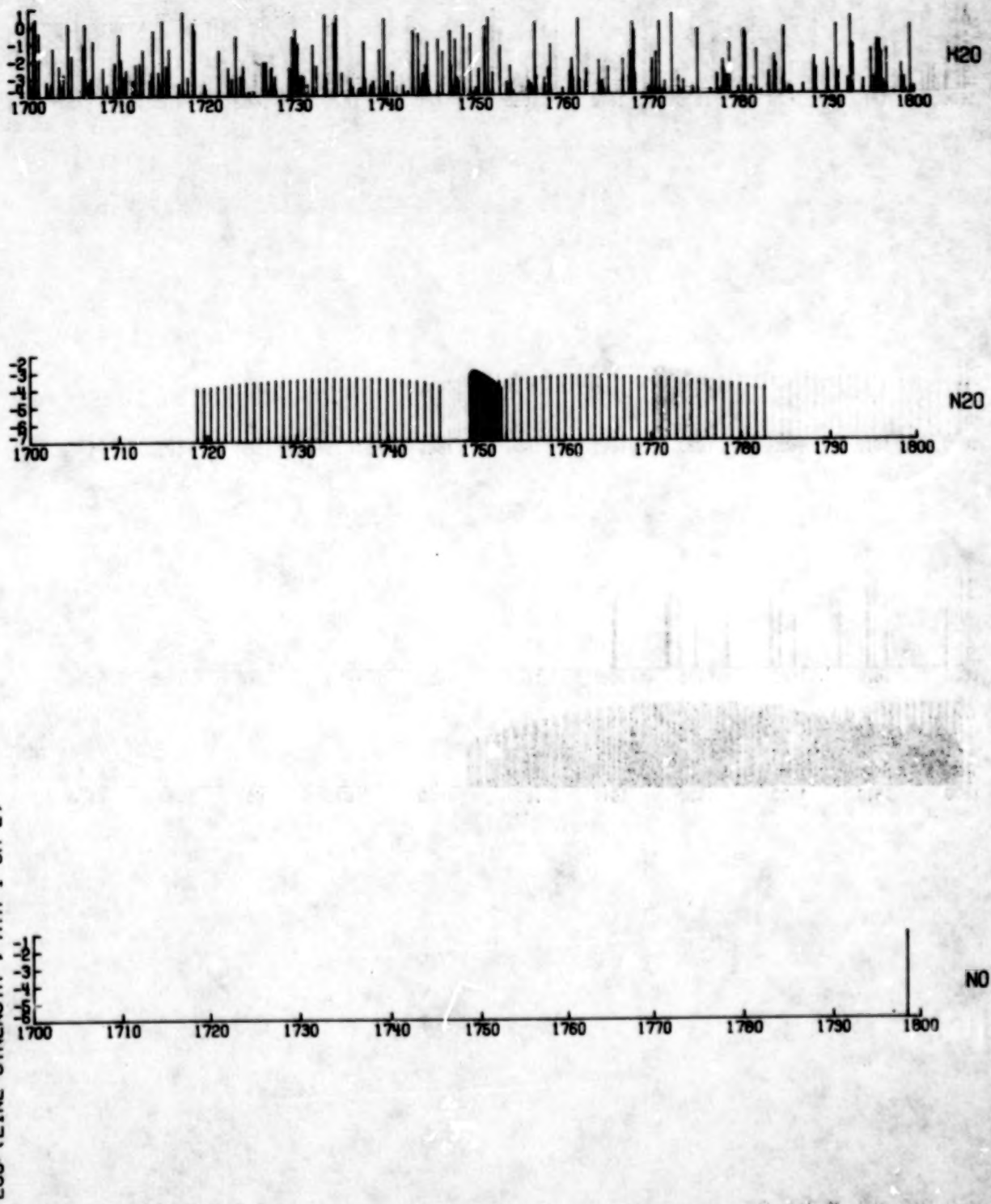


FIG.13. LINE STRENGTH VS. WAVENUMBER (1700 AND 1800 CM-1, 5.88 - 5.55 MICRON)

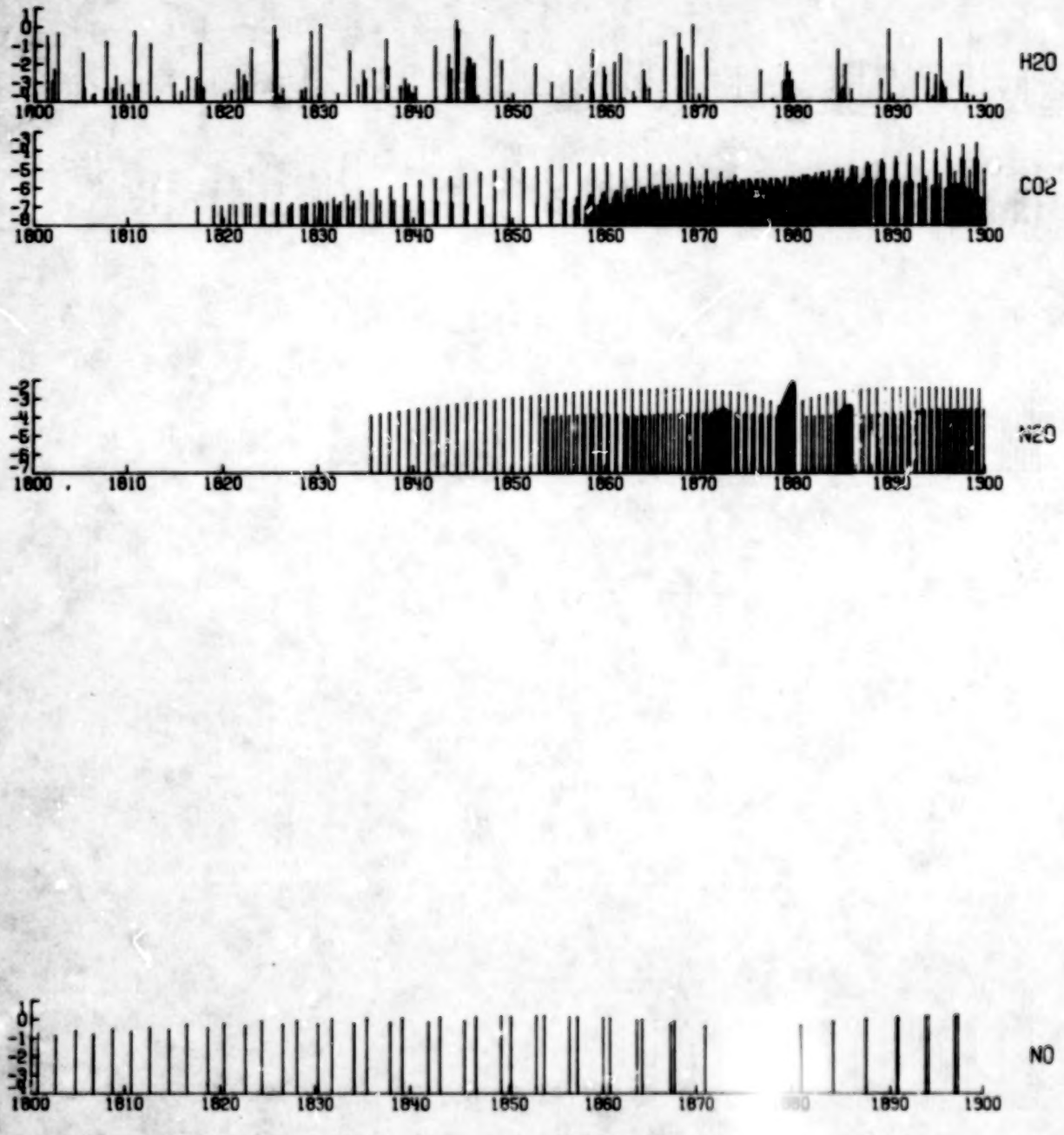


FIG-14. LINE STRENGTH VS. WAVENUMBER (1800 AND 1900 CM-1, 5.55 - 5.26 MICRON)

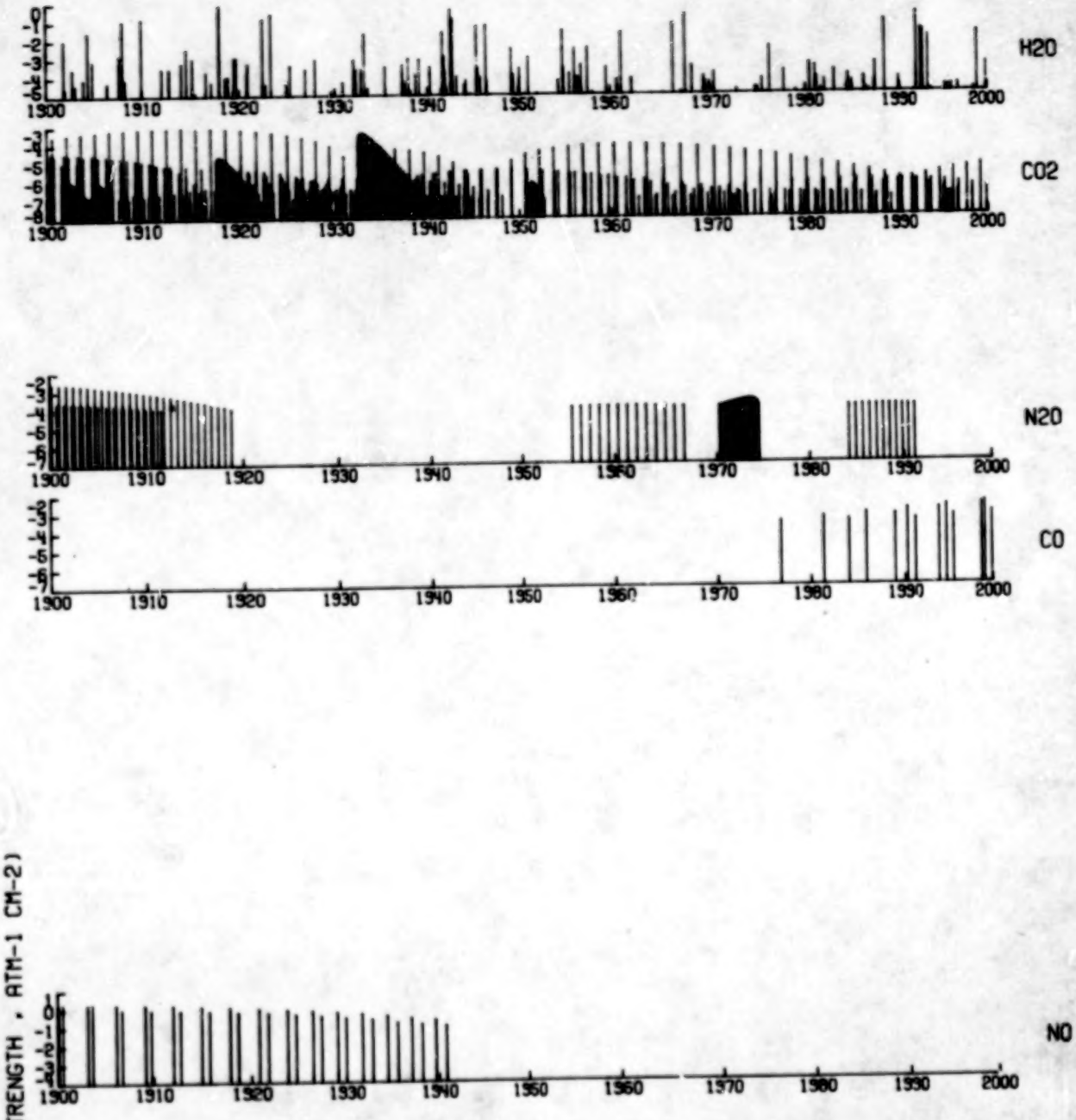
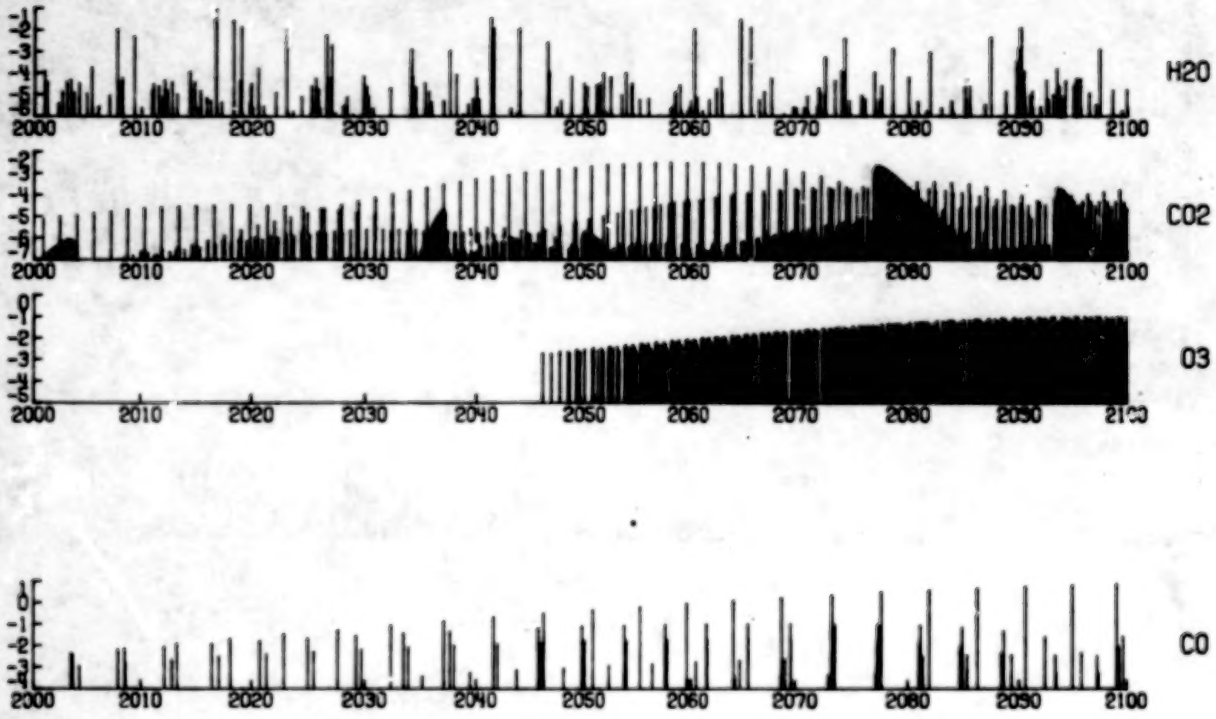


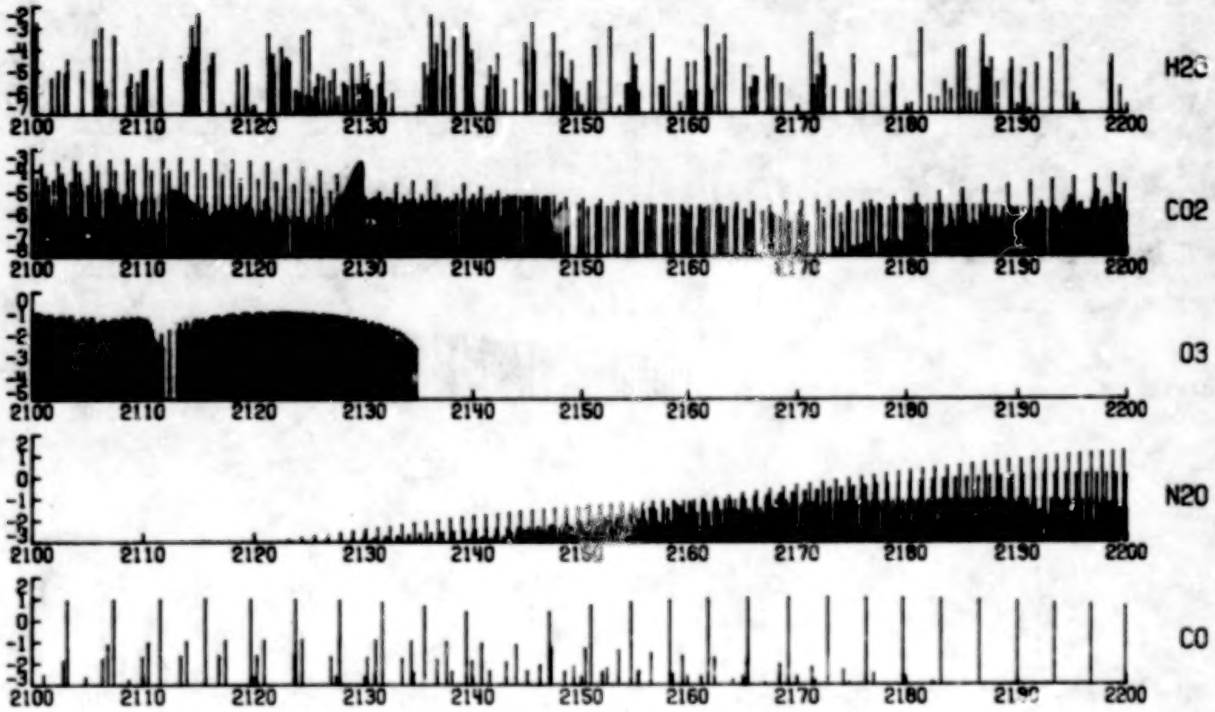
FIG.15. LINE STRENGTH VS. WAVENUMBER (1900 AND 2000 CM-1, 5.26 - 5.00 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

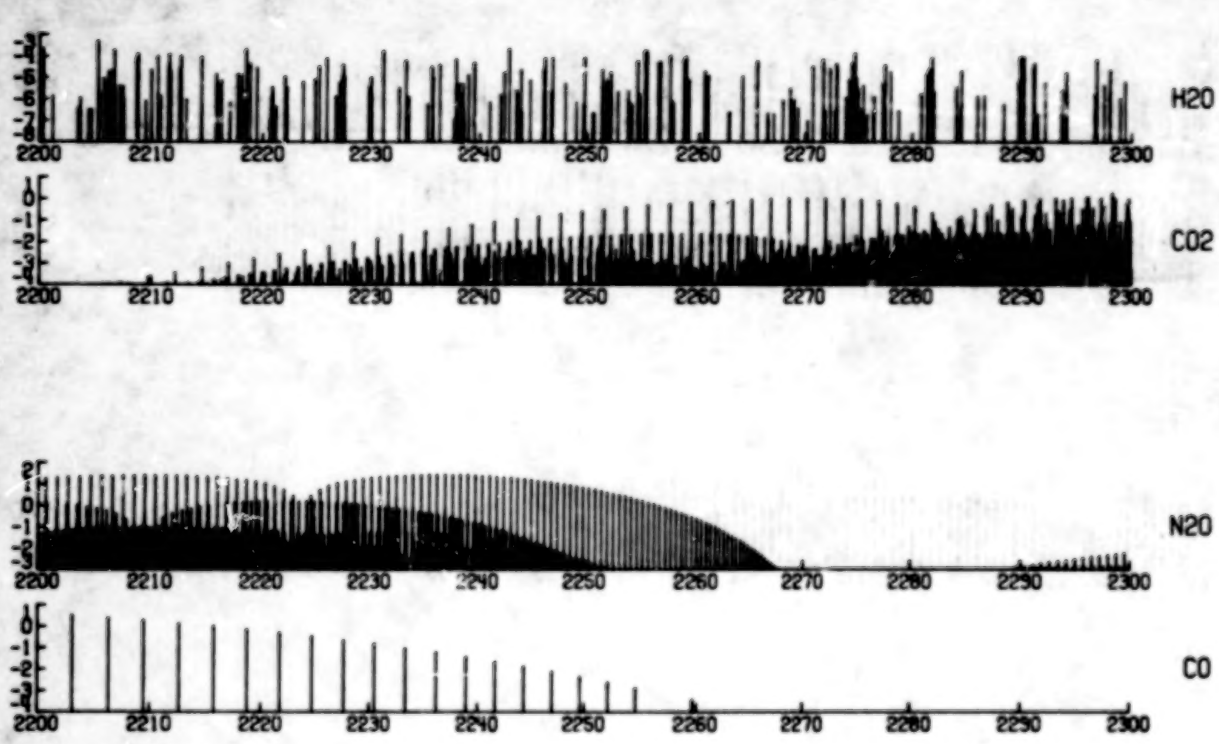
FIG.16. LINE STRENGTH VS. WAVENUMBER (2000 AND 2100 CM-1. 5.00 - 4.76 MICRON)



LOG (LINE STRENGTH , ATM-1 CM-2)

WAVENUMBER

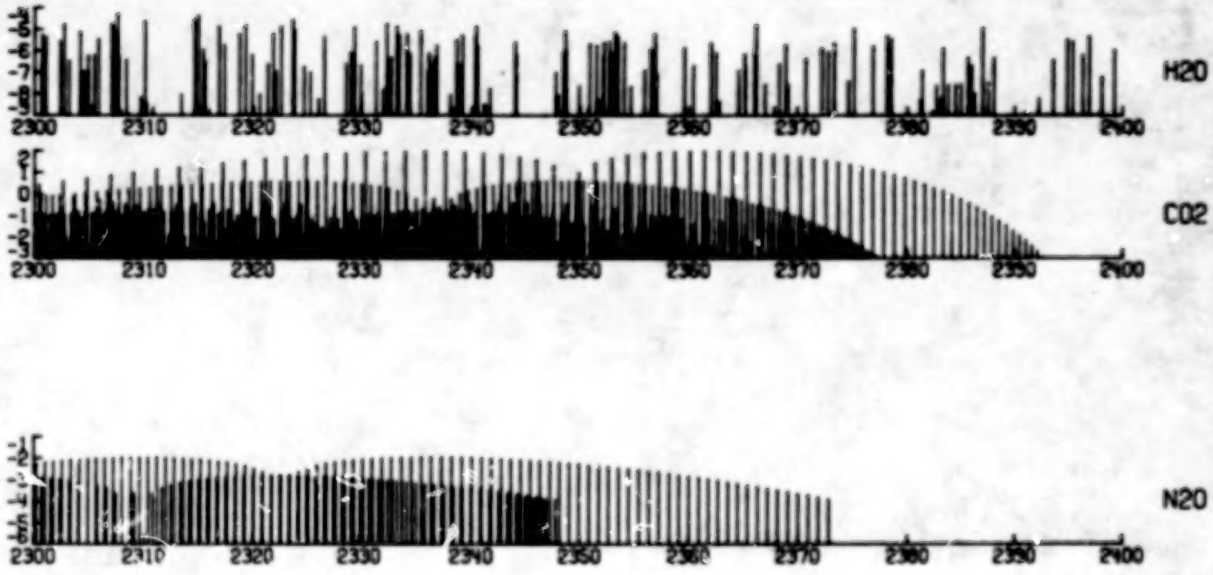
FIG.17. LINE STRENGTH VS. WAVENUMBER (2100 AND 2210 CM-1, 4.76 - 4.54 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

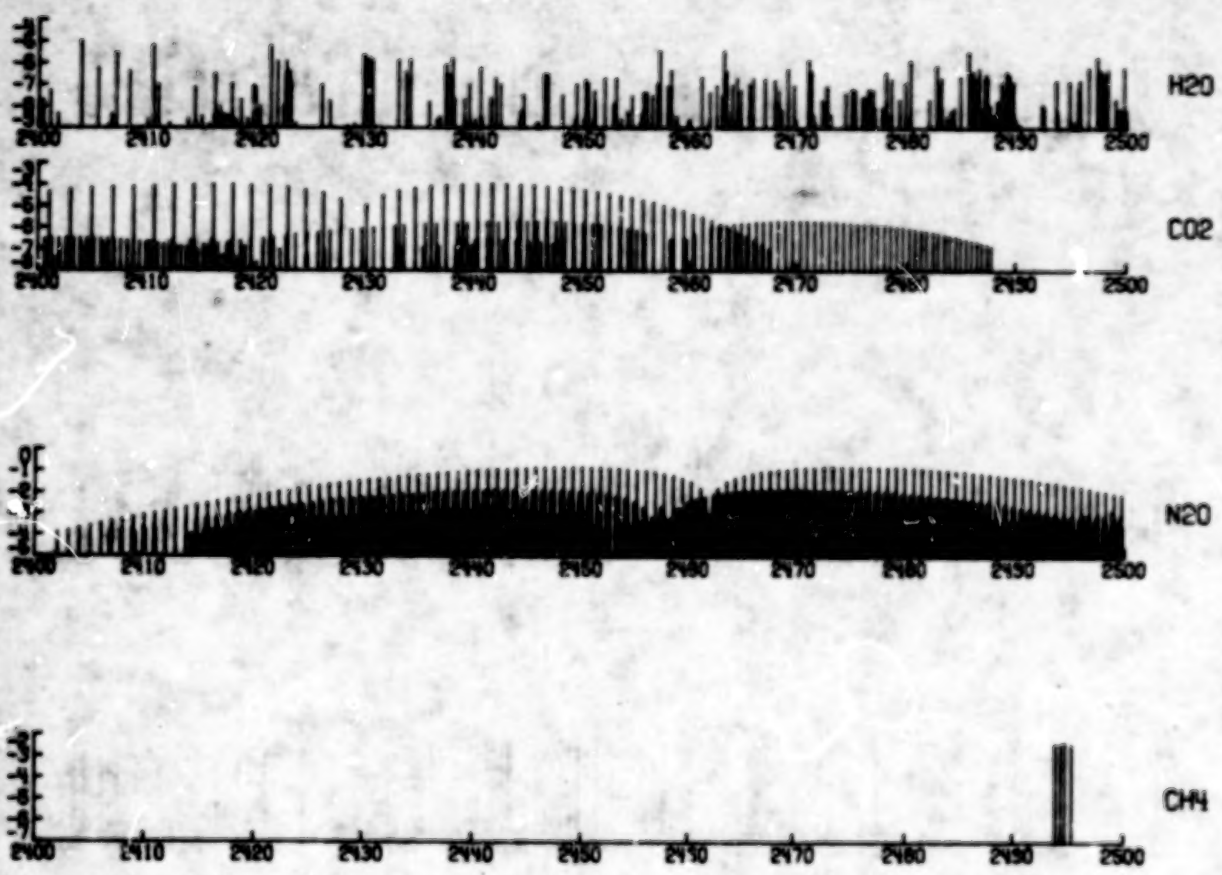
FIG.18. LINE STRENGTH VS. WAVENUMBER (2200 AND 2300 CM-1, 4.54 - 4.34 MICRON)



LOG LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

FIG.13. LINE STRENGTH VS. WAVENUMBER (2300 AND 2400 CM-1. 4.34 - 4.16 MICRON)



LOG (LINE STRENGTH • ATM-1 CM-2)

WAVENUMBER

FIG.80. LINE STRENGTH VS. WAVENUMBER (2400 AND 2500 CM-1, 4.16 - 4.00 MICRON)

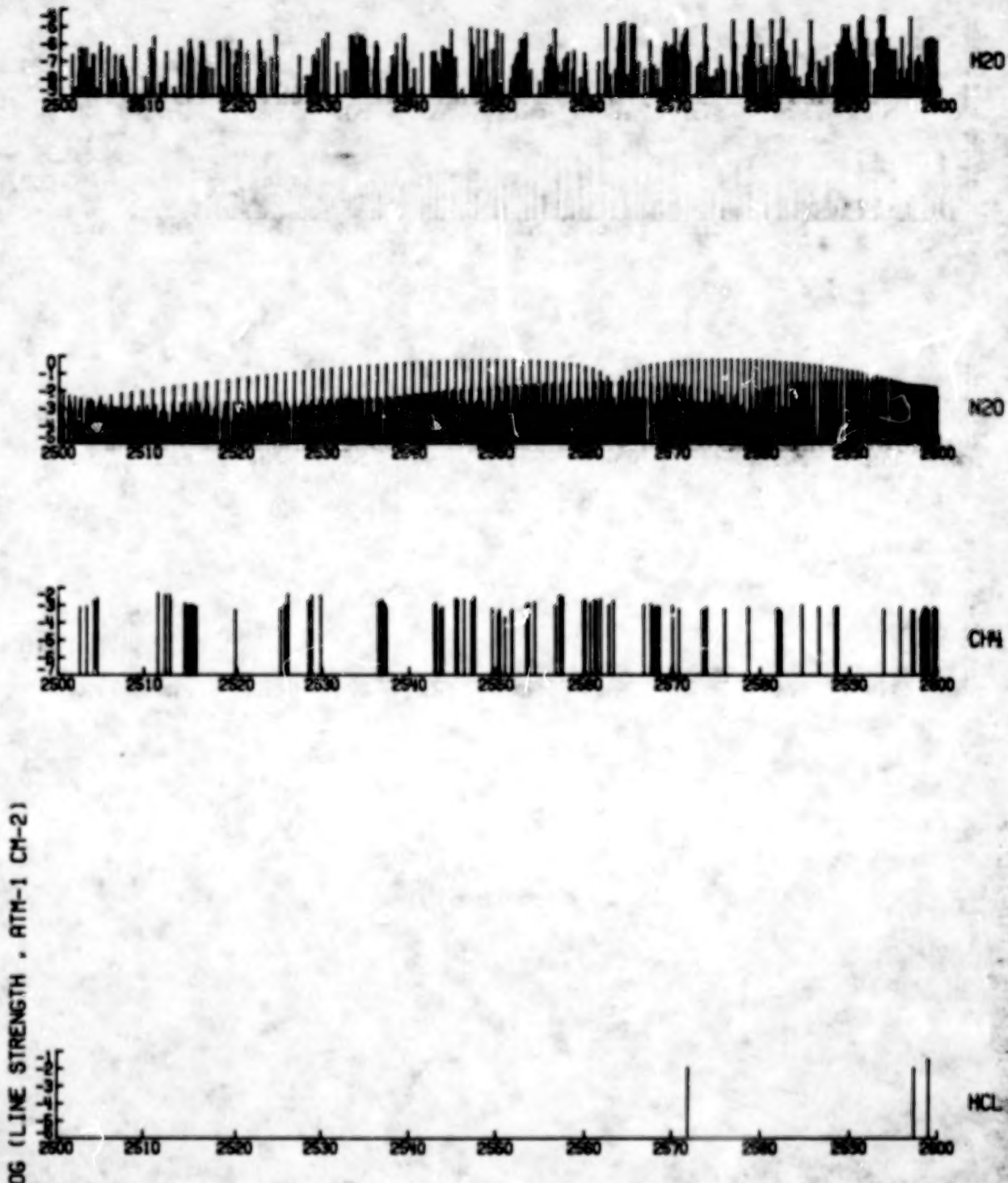


FIG-21. LINE STRENGTH VS. WAVENUMBER (2500 AND 2600 CM-1, 4.00 - 3.84 MICRON)

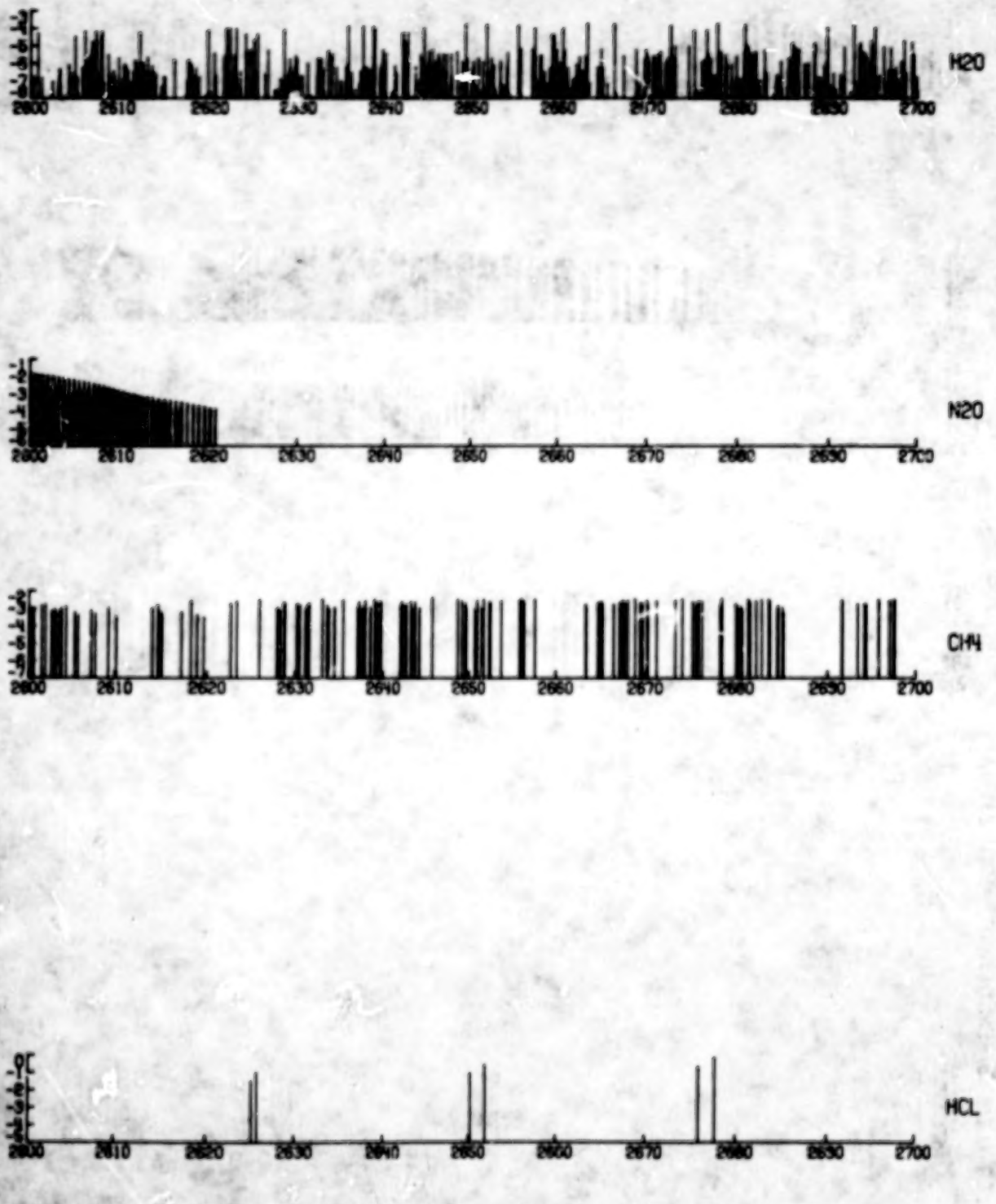


FIG-22. LINE STRENGTH VS. WAVENUMBER (2600 AND 2700 CM-1, 3.84 - 3.70 MICRON)

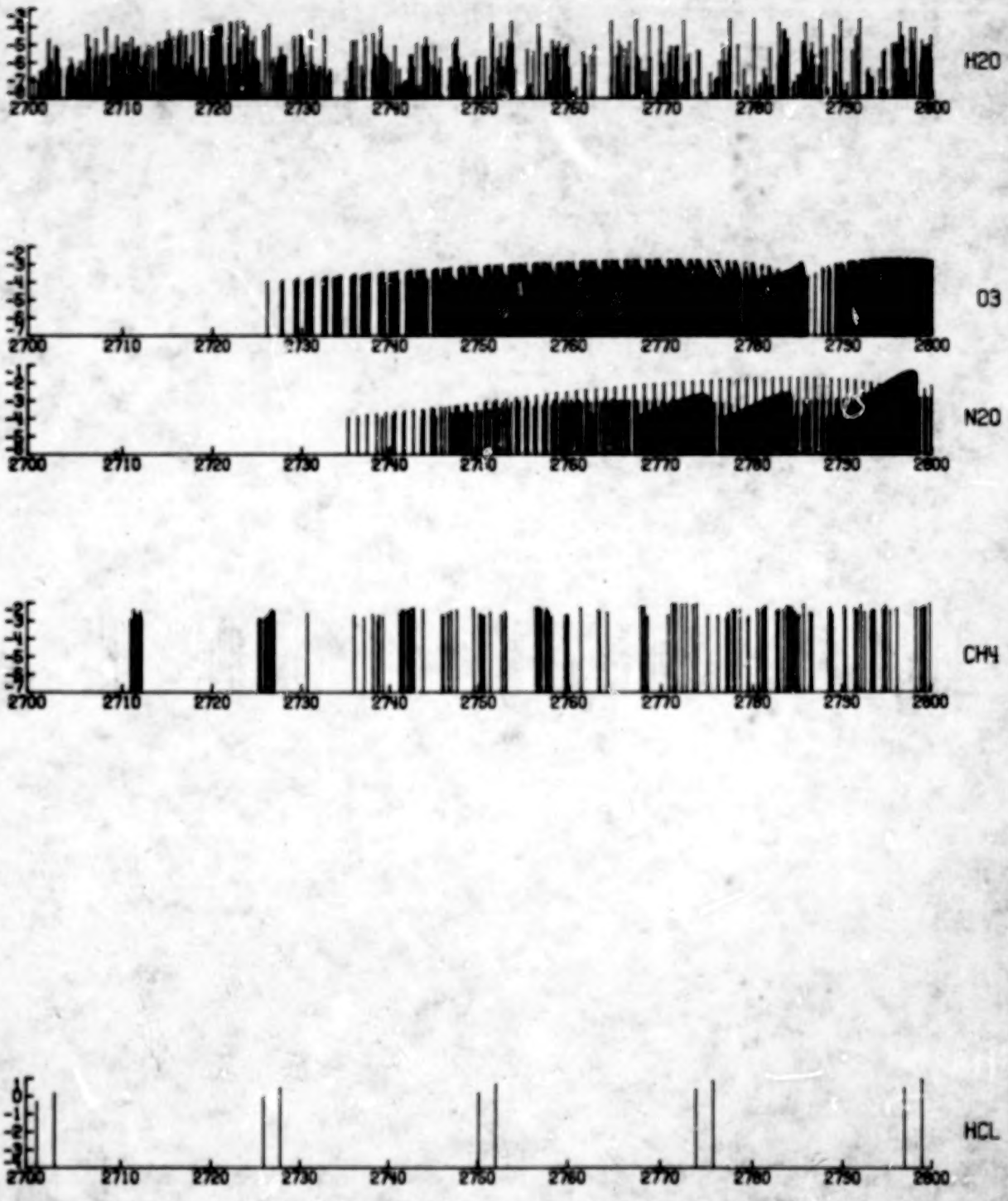


FIG-23. LINE STRENGTH VS. WAVENUMBER (2700 AND 2800 CM-1, 3.70 - 3.57 MICRON)

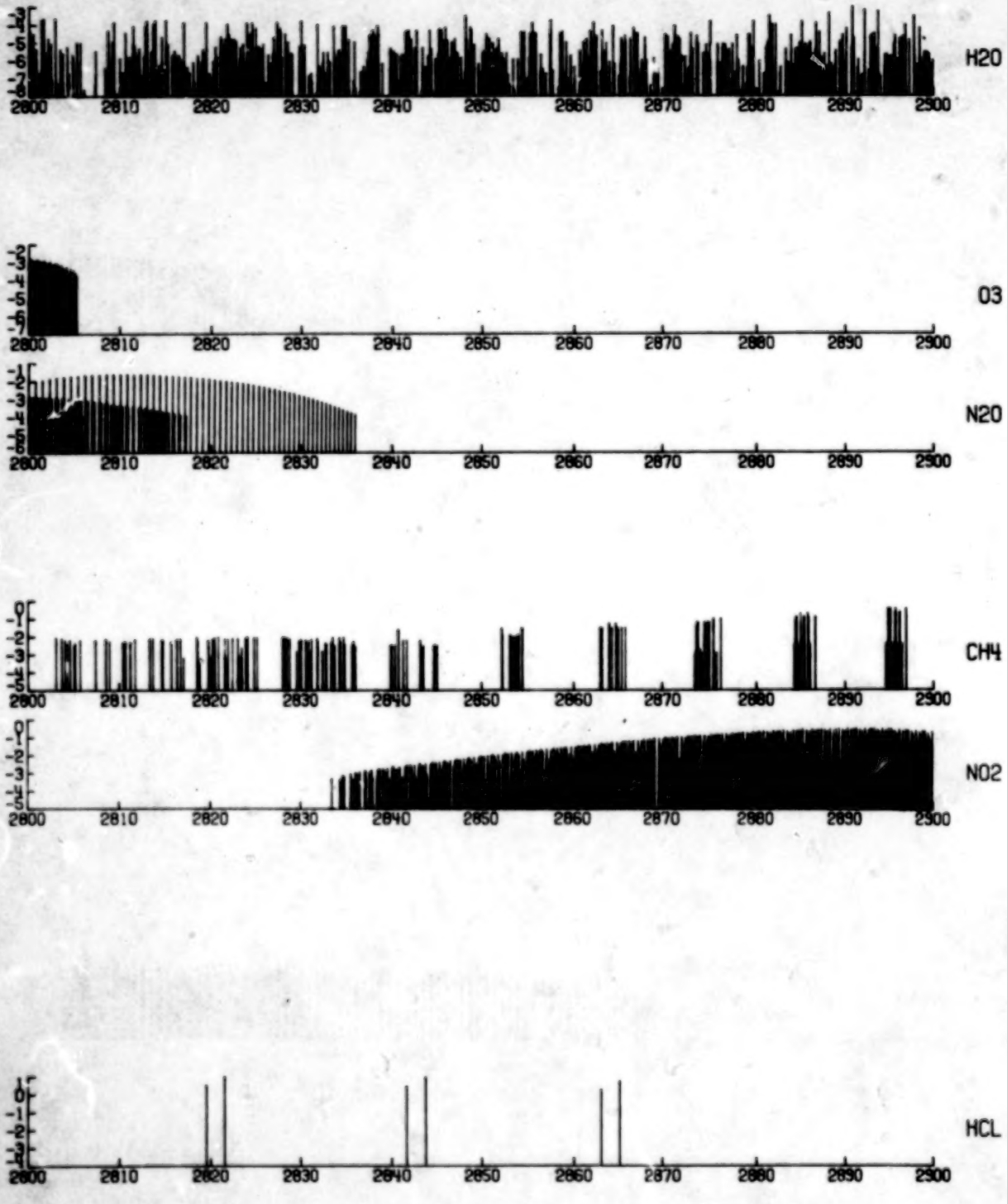


FIG.24. LINE STRENGTH VS. WAVENUMBER (2800 AND 2900 CM-1, 3.57 - 3.44 MICRON)

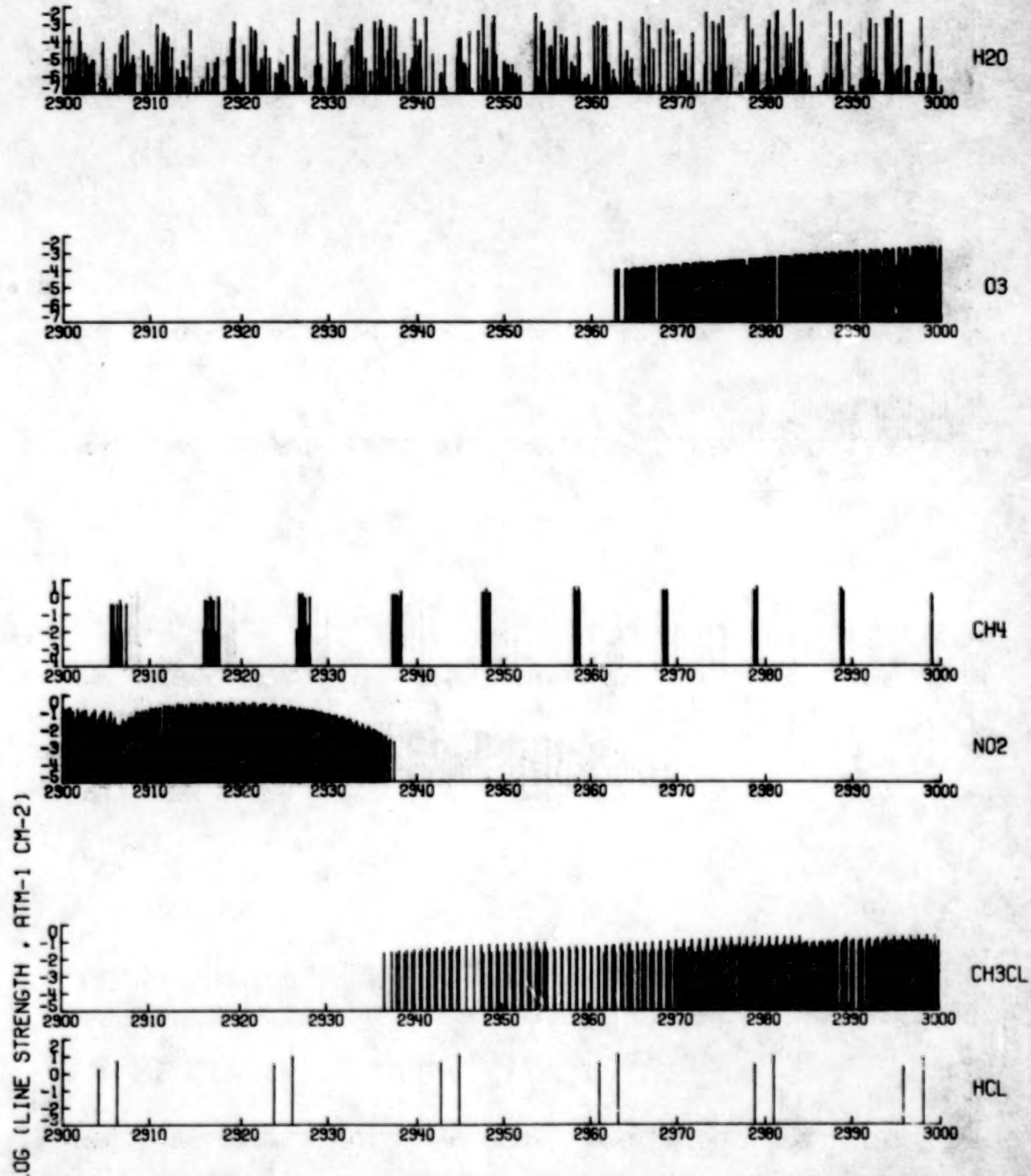


FIG.25. LINE STRENGTH VS. WAVENUMBER (2900 AND 3000 CM-1, 3.44 - 3.33 MICRON)

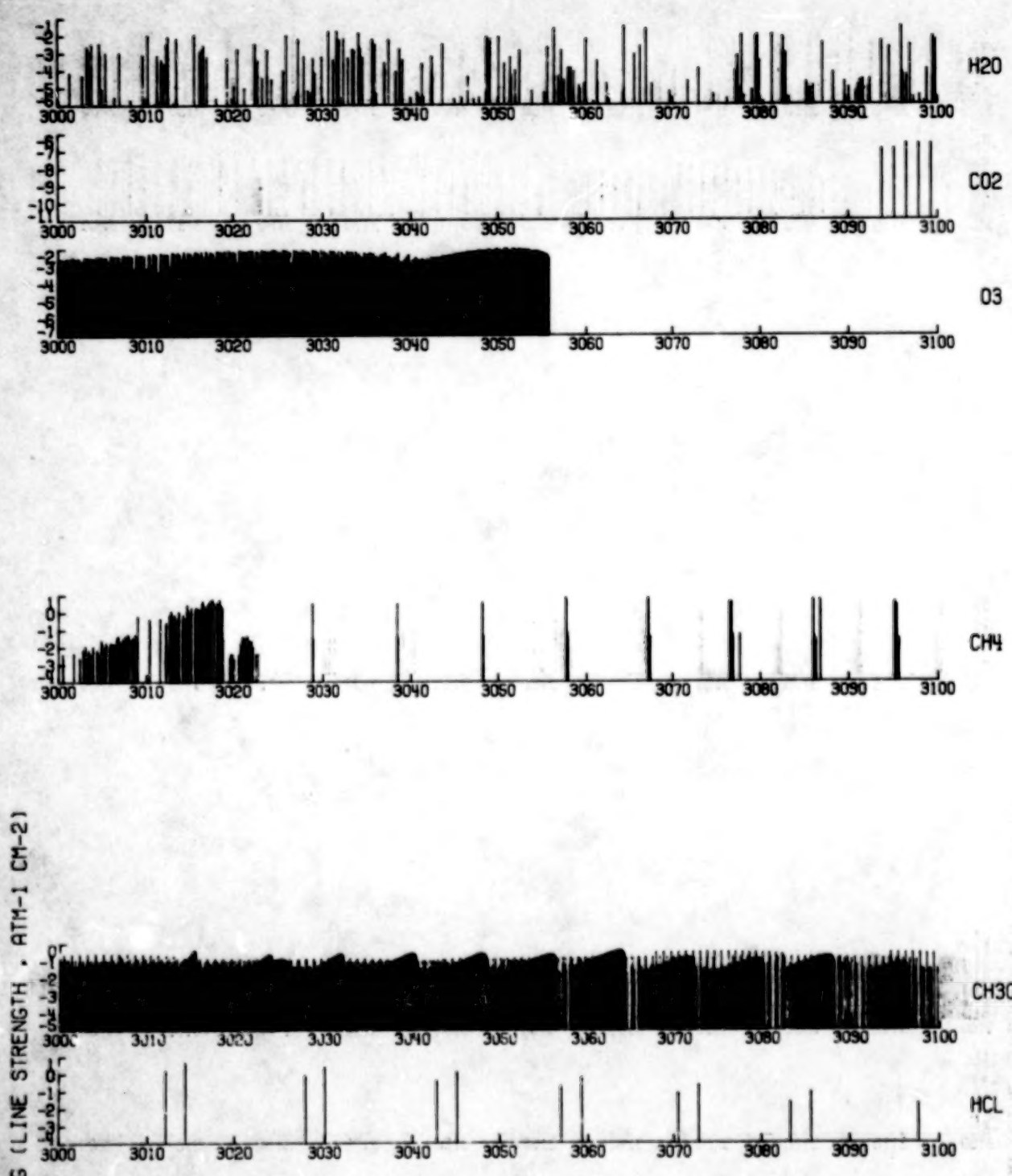


FIG.26. LINE STRENGTH VS. WAVENUMBER (3000 AND 3100 CM-1, 3.33 - 3.22 MICRON)

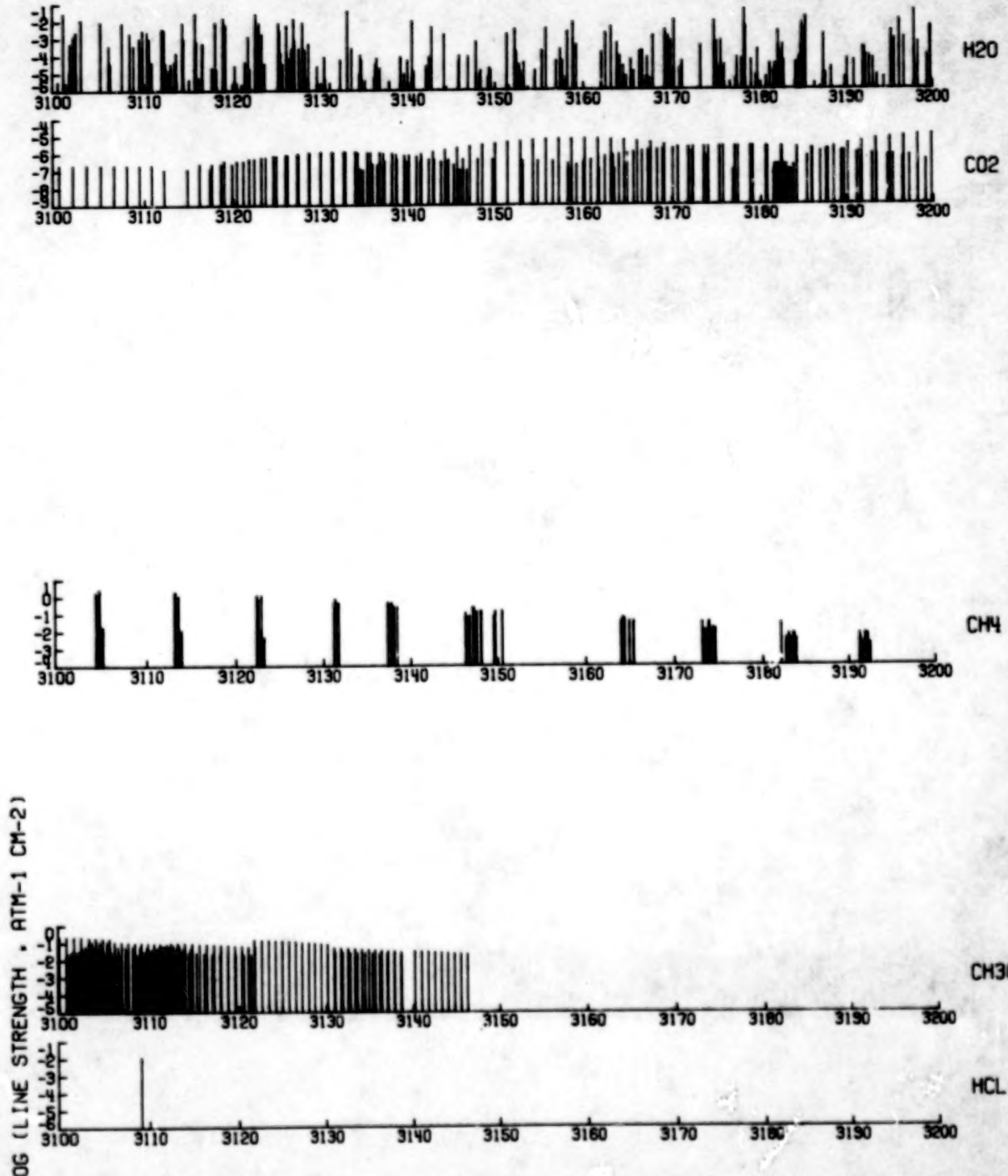
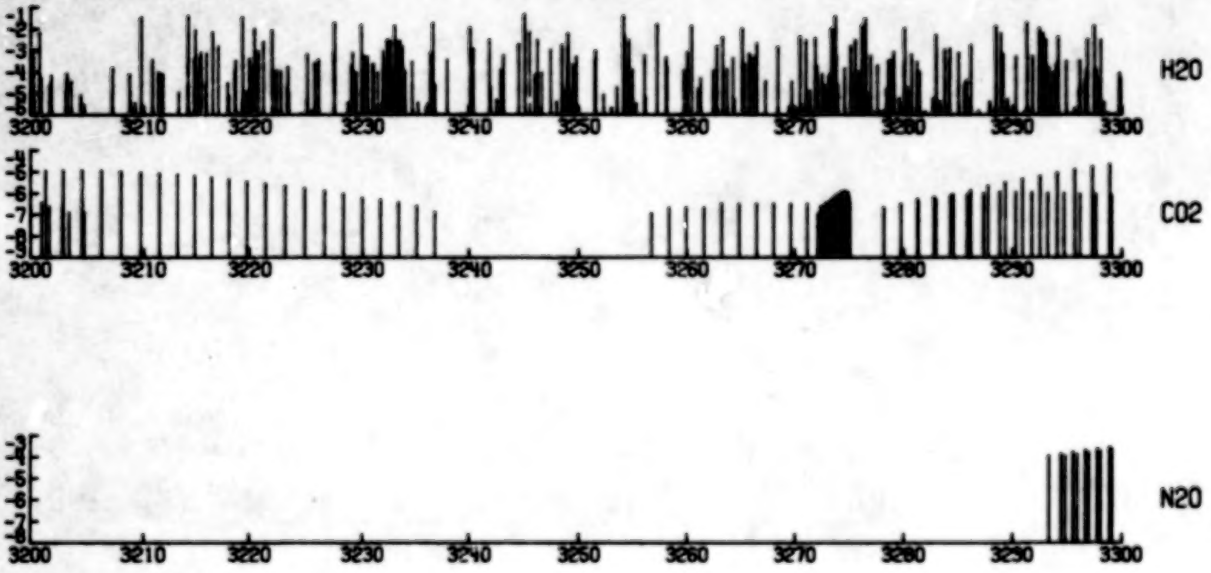


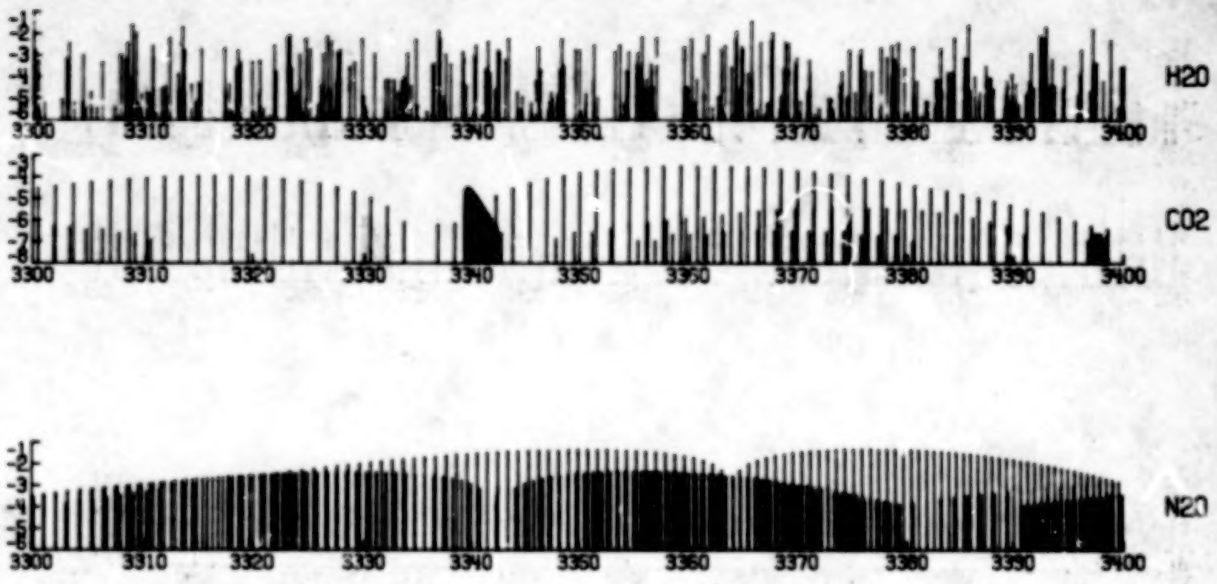
FIG.27. LINE STRENGTH VS. WAVENUMBER (3100 AND 3200 CM-1. 3.22 - 3.12 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

FIG.28. LINE STRENGTH VS. WAVENUMBER (3200 AND 3300 CM-1. 3.12 - 3.03 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

FIG-29. LINE STRENGTH VS. WAVENUMBER (3300 AND 3400 CM-1, 3.03 - 2.94 MICRON)

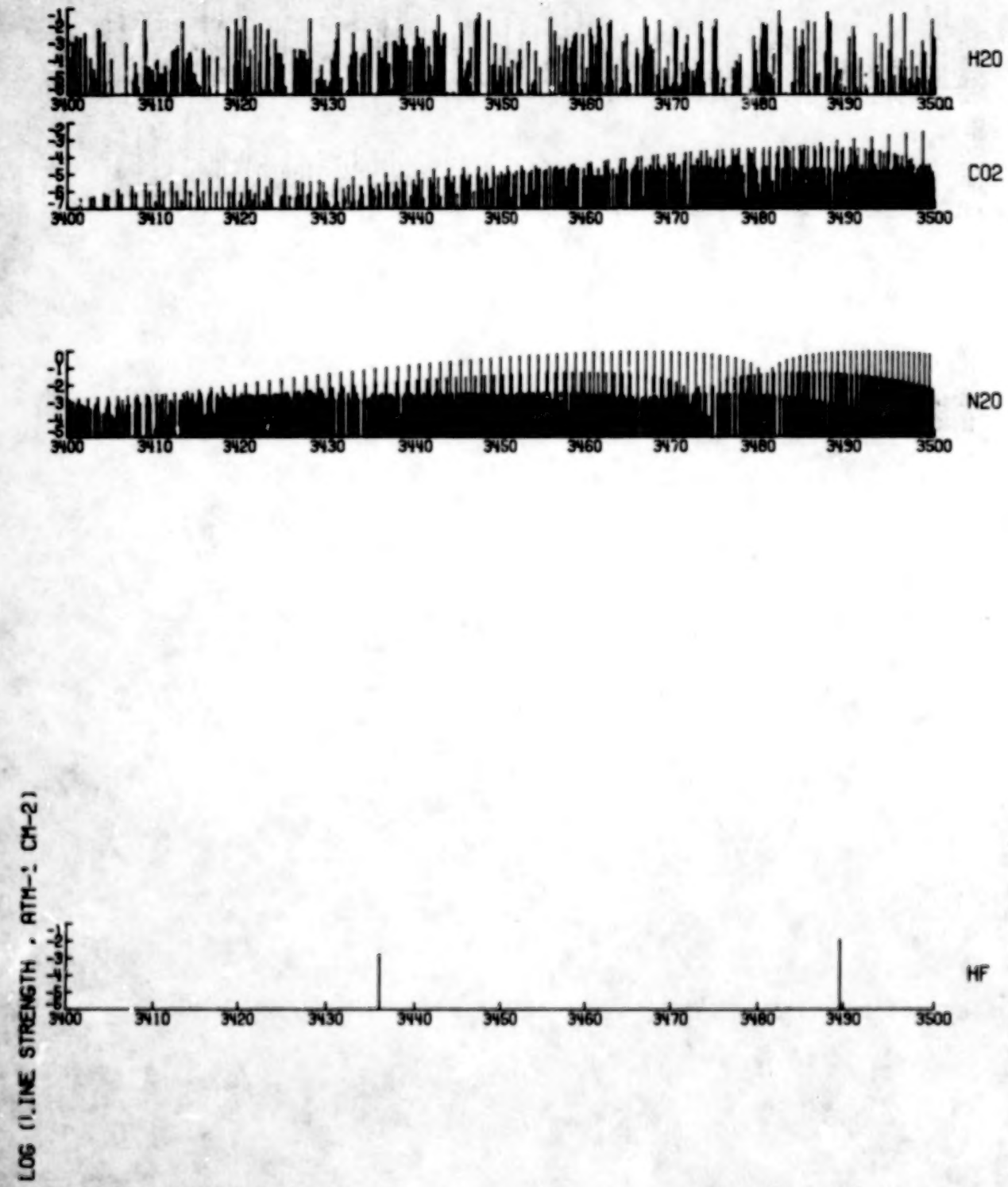


FIG.30. LINE STRENGTH VS. WAVENUMBER (3400 AND 3500 CM-1. 2.94 - 2.85 MICRON)

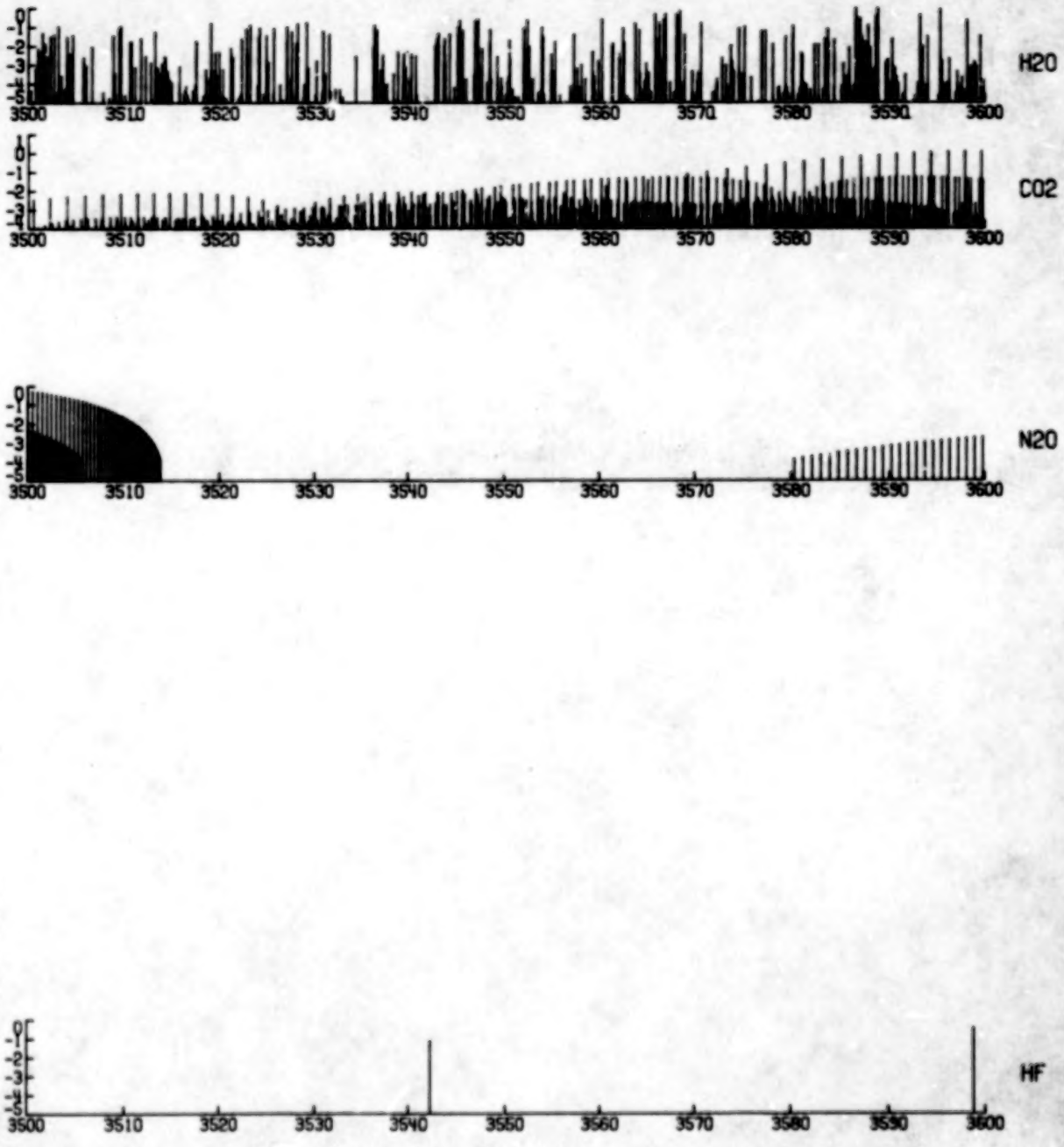


FIG.31. LINE STRENGTH VS. WAVENUMBER (3500 AND 3600 CM-1, 2.85 - 2.77 MICRON)

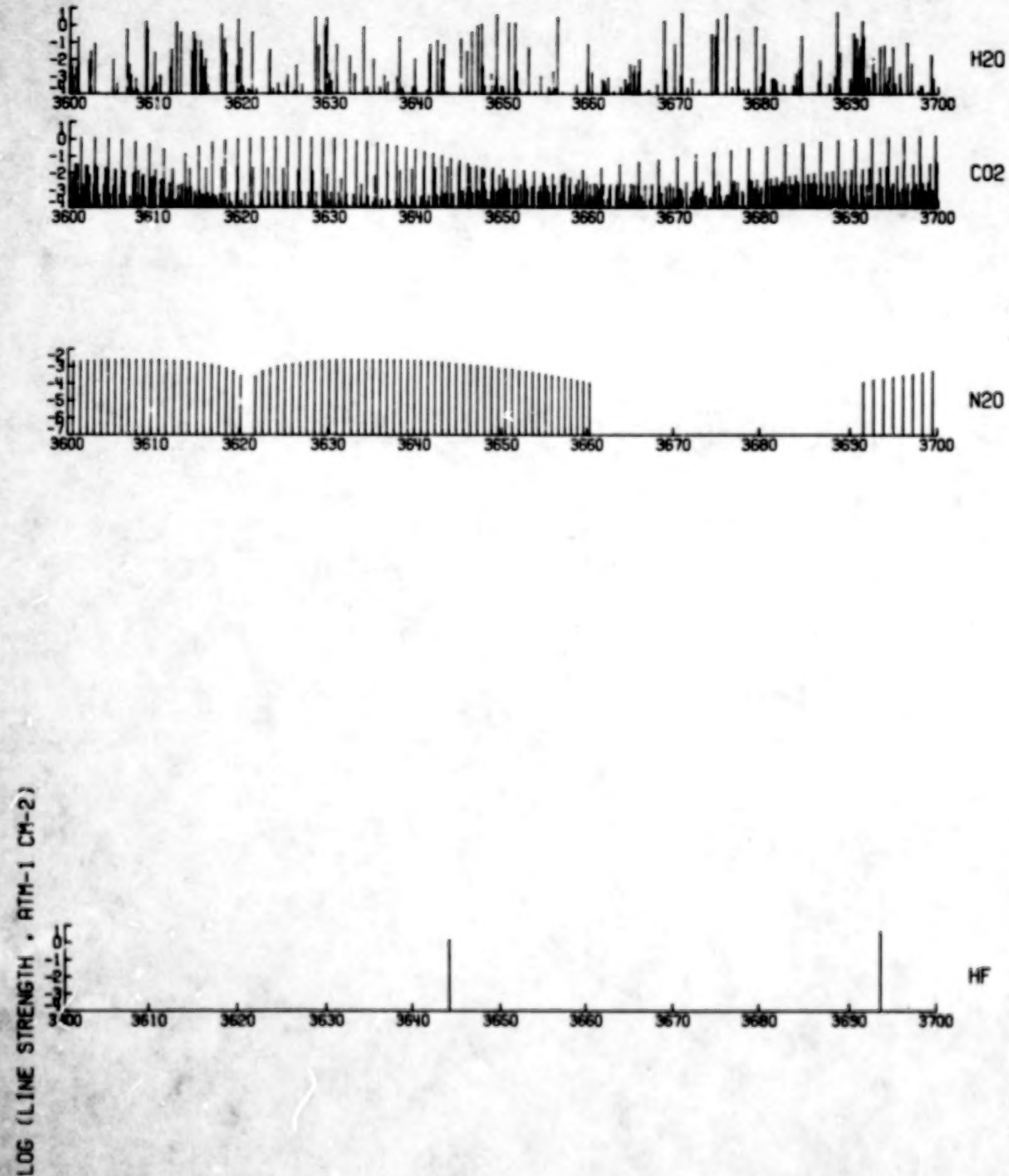
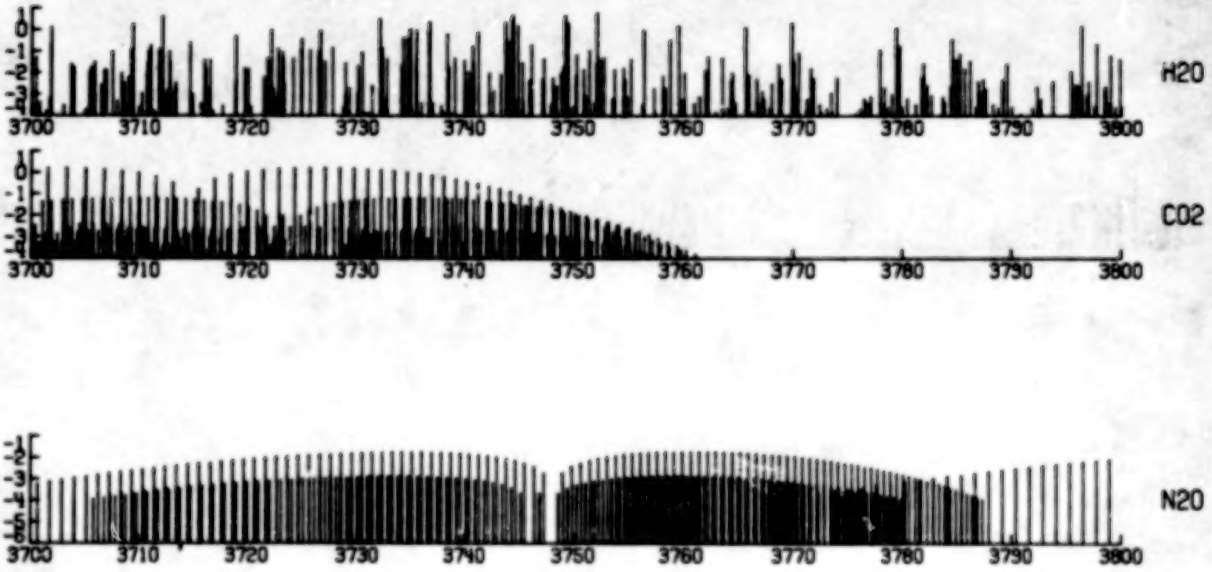


FIG.32. LINE STRENGTH VS. WAVENUMBER (3600 AND 3700 CM-1, 2.77 - 2.70 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

FIG.33. LINE STRENGTH VS. WAVENUMBER (3700 AND 3800 CM-1, 2.70 - 2.63 MICRON)

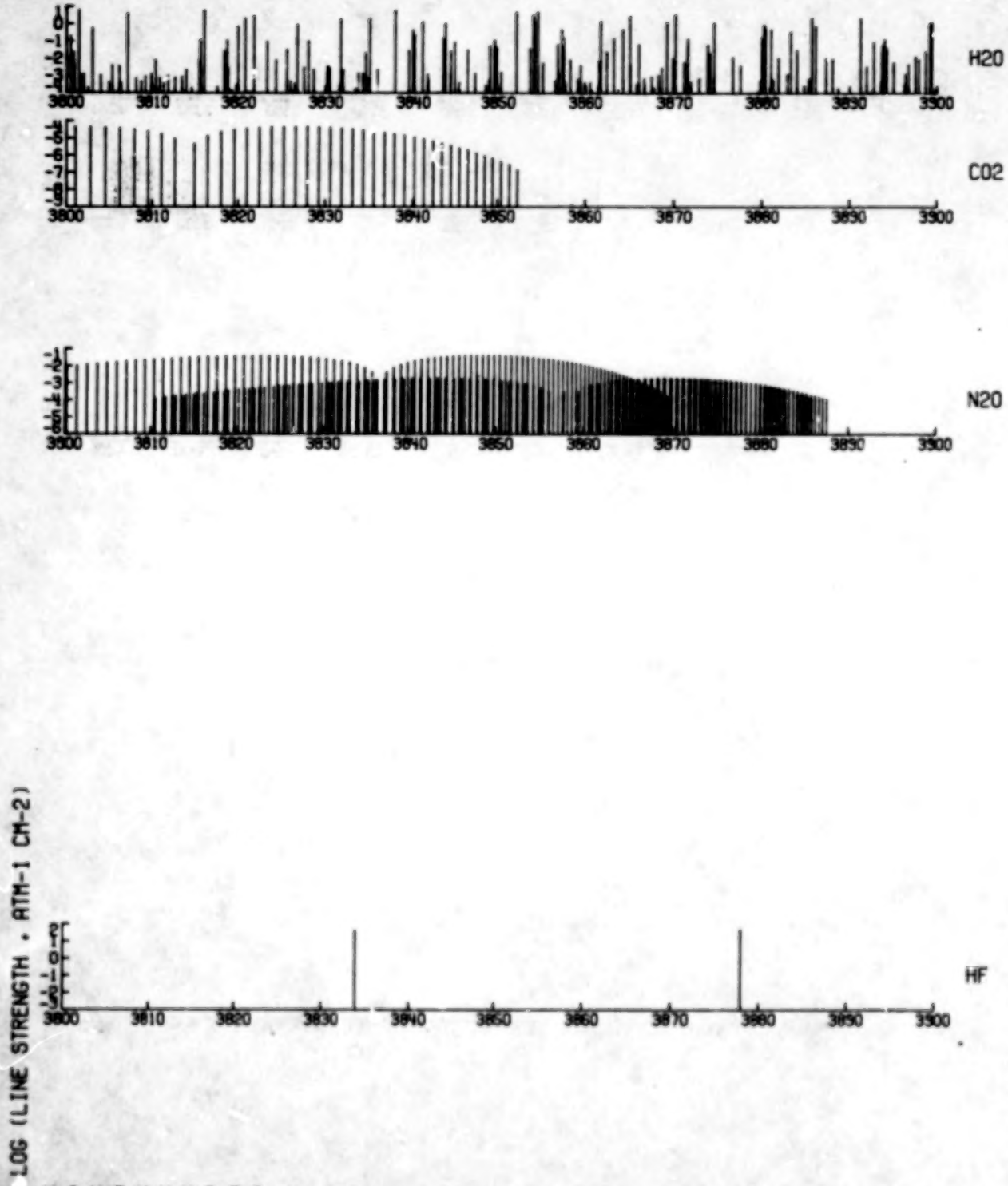


FIG.34. LINE STRENGTH VS. WAVENUMBER (3800 AND 3900 CM-1, 2.63 - 2.56 MICRON)

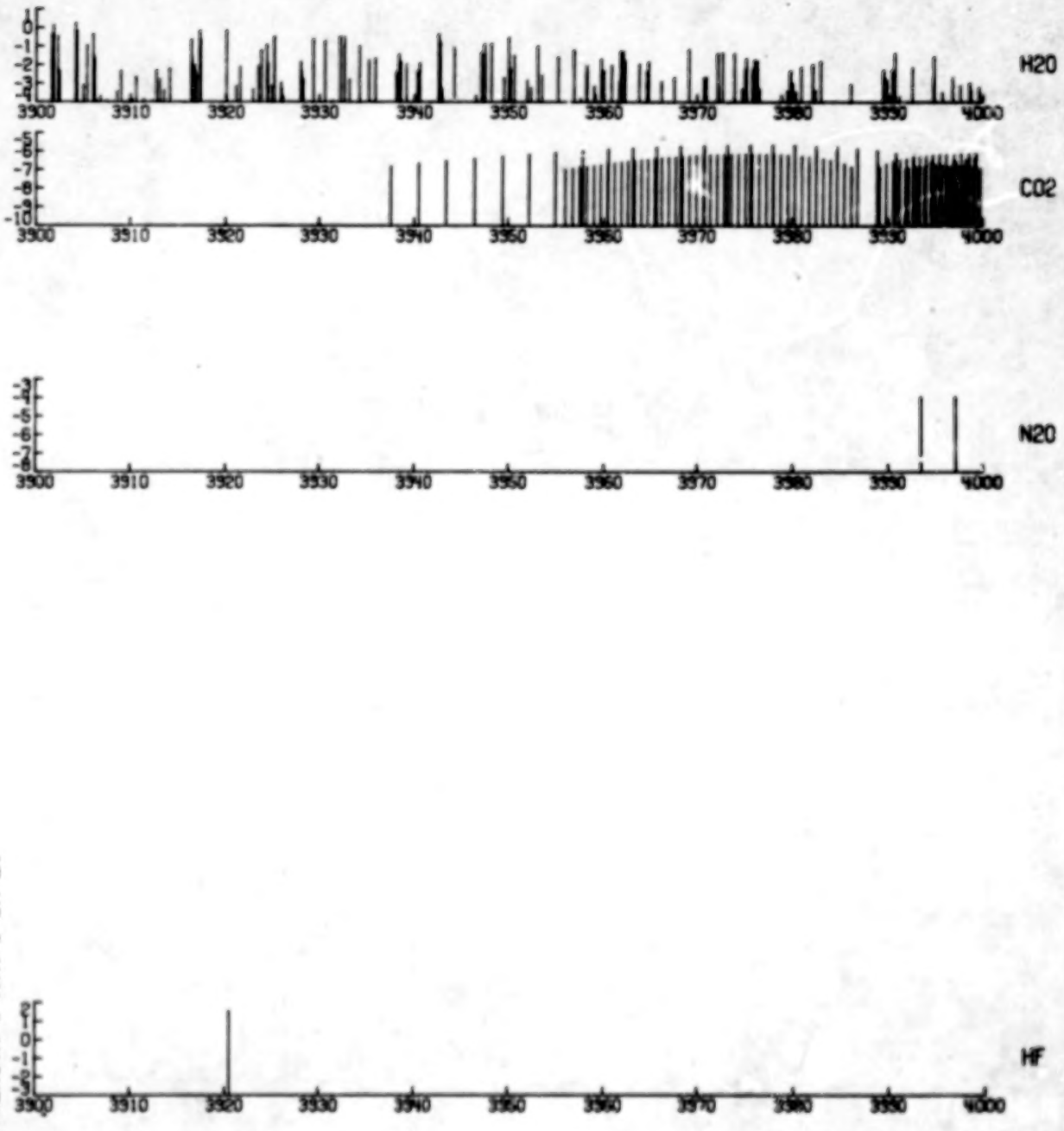


FIG.35. LINE STRENGTH VS. WAVENUMBER (3900 AND 4000 CM-1, 2.56 - 2.50 MICRON)

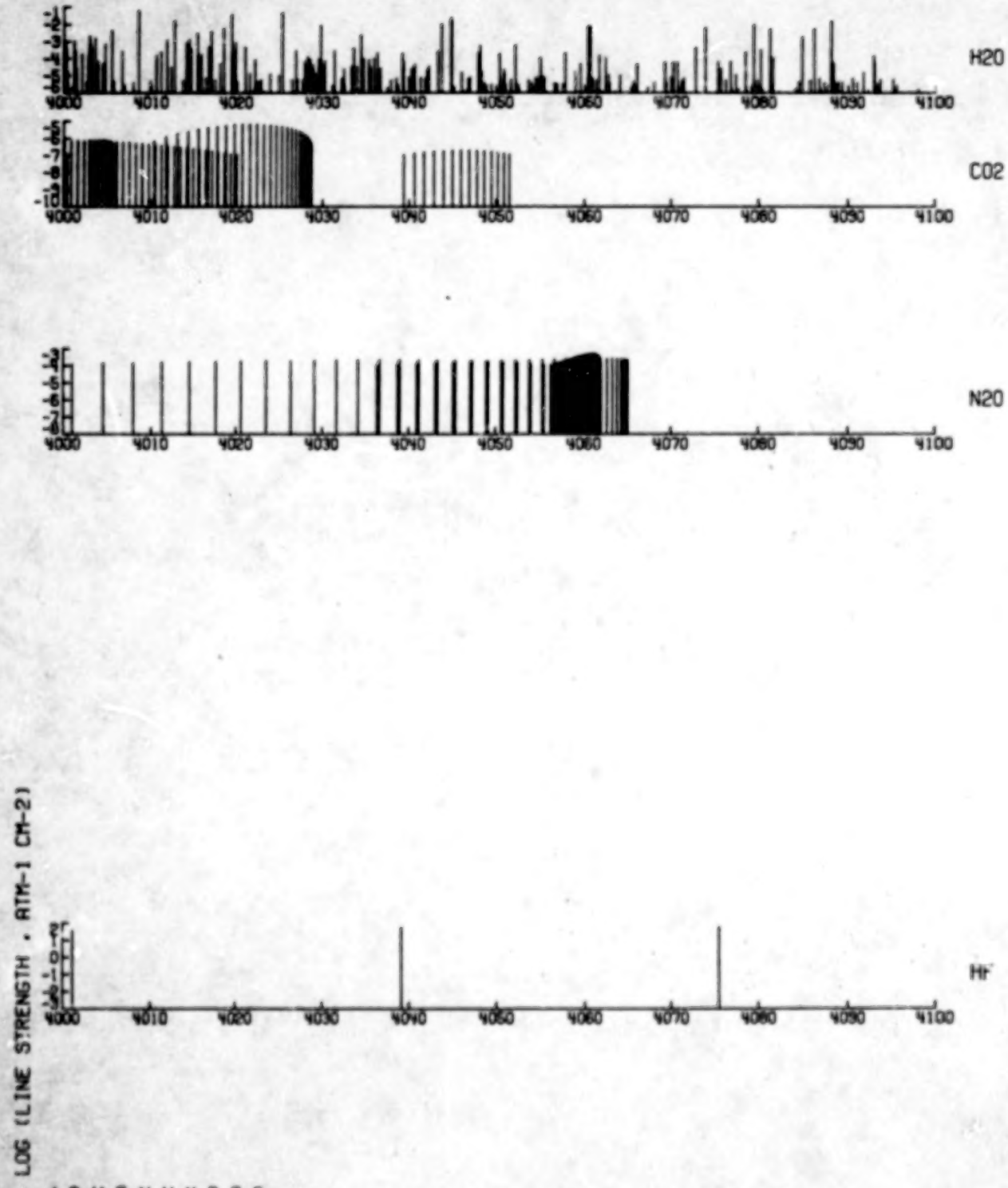


FIG.36. LINE STRENGTH VS. WAVENUMBER (4000 AND 4100 CM-1, 2.50 - 2.43 MICRON)

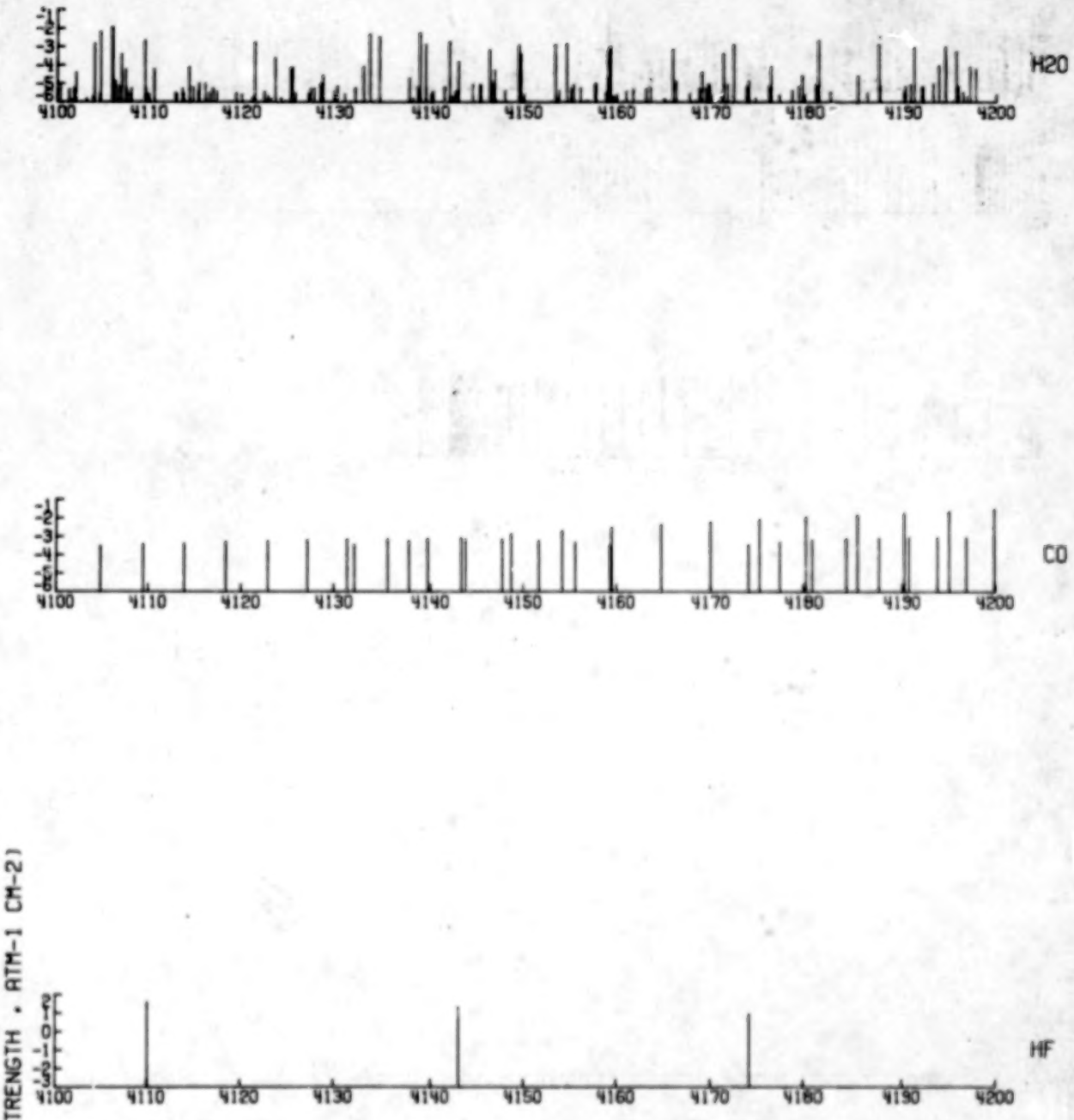


FIG.37. LINE STRENGTH VS. WAVENUMBER (4100 AND 4200 CM-1, 2.43 - 2.38 MICRON)

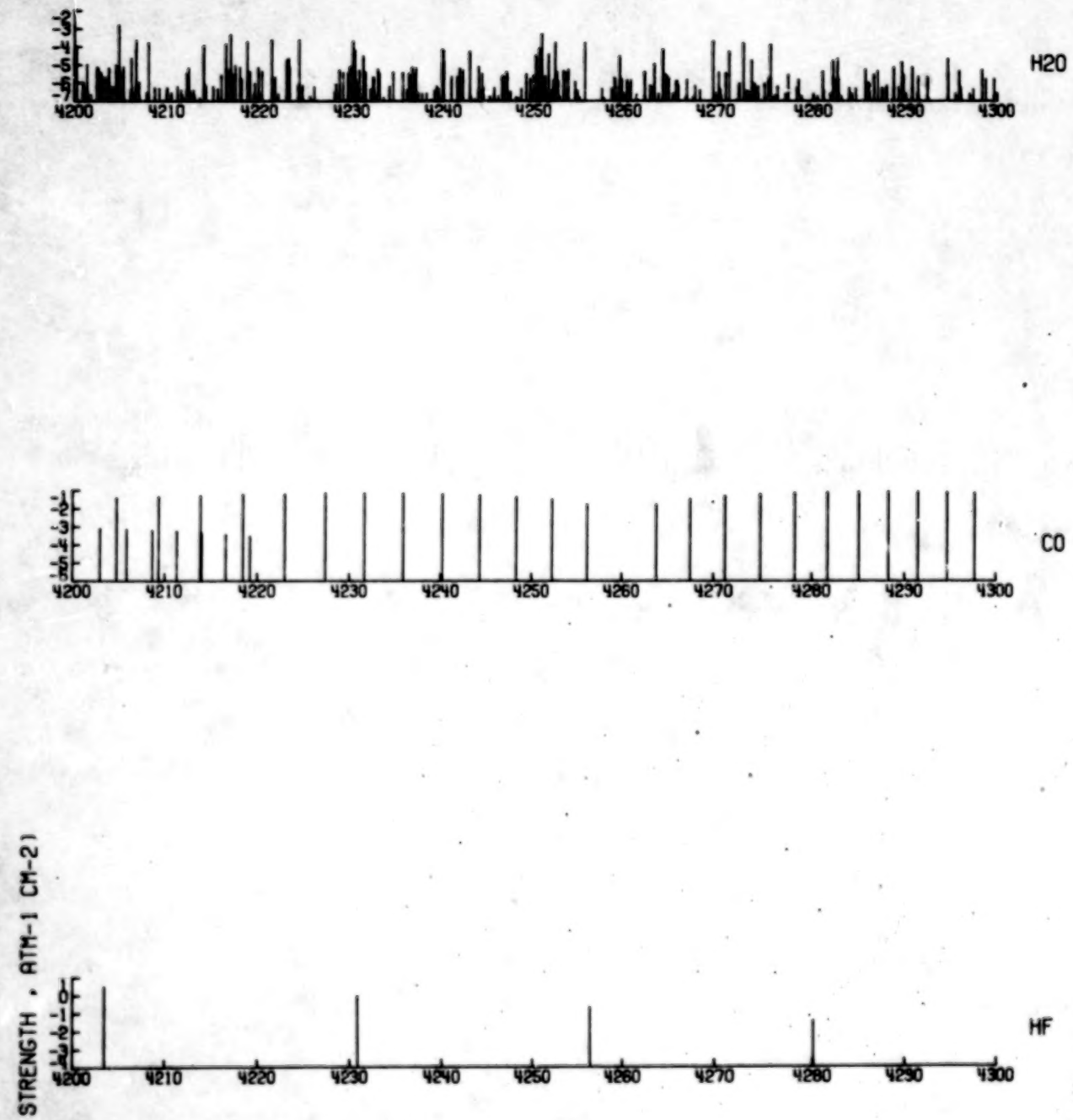
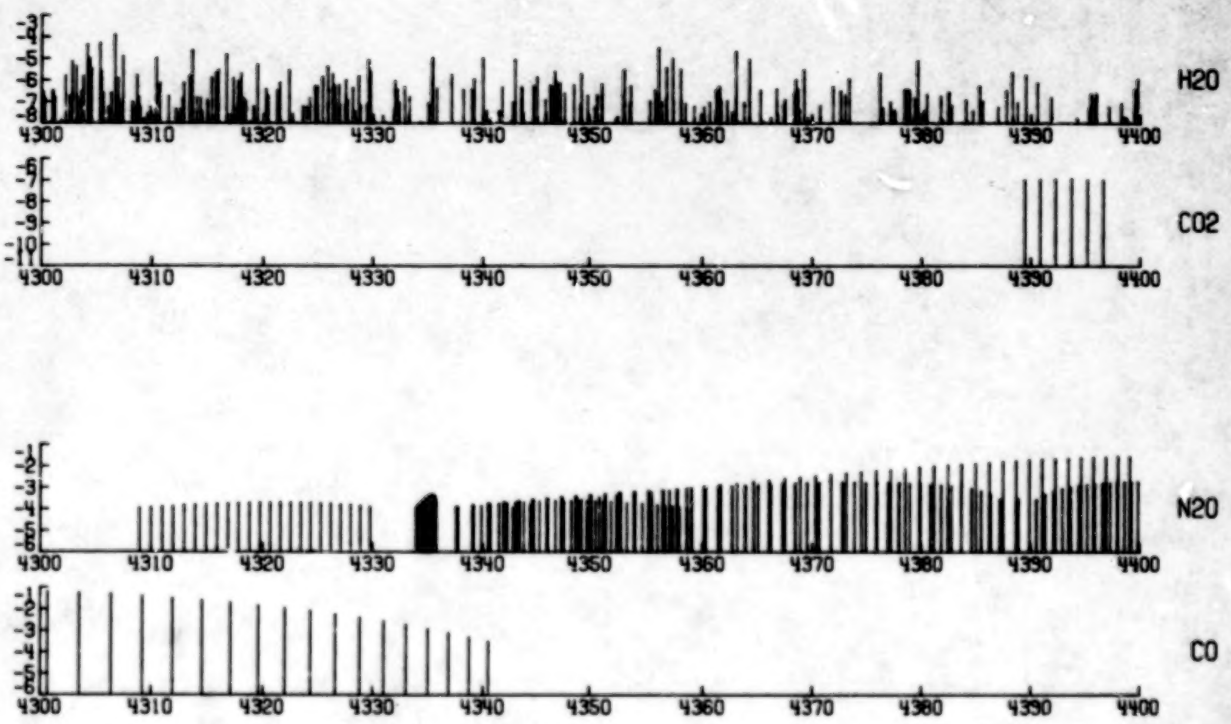


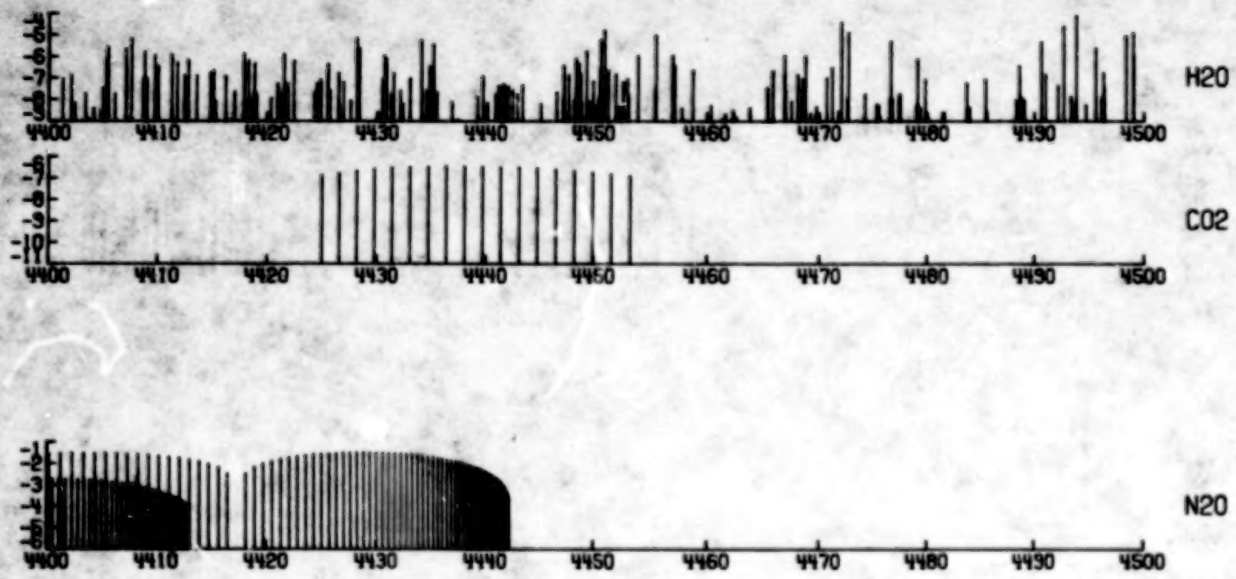
FIG.38. LINE STRENGTH VS. WAVENUMBER (4200 AND 4300 CM-1, 2.38 - 2.32 MICRON)



LOG (LINE STRENGTH • ATM-1 CM-2)

WAVENUMBER

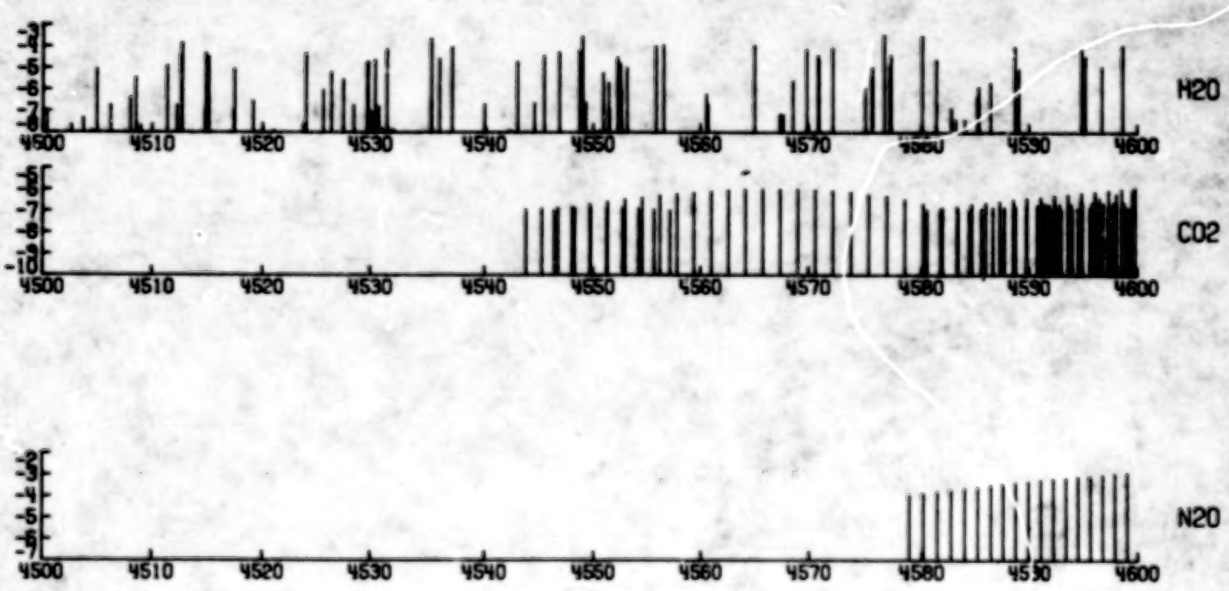
FIG.39. LINE STRENGTH VS. WAVENUMBER (4300 AND 4400 CM-1. 2.32 - 2.27 MICRON)



LOG (LINE STRENGTH , ATM-1 CM-2)

WAVENUMBER

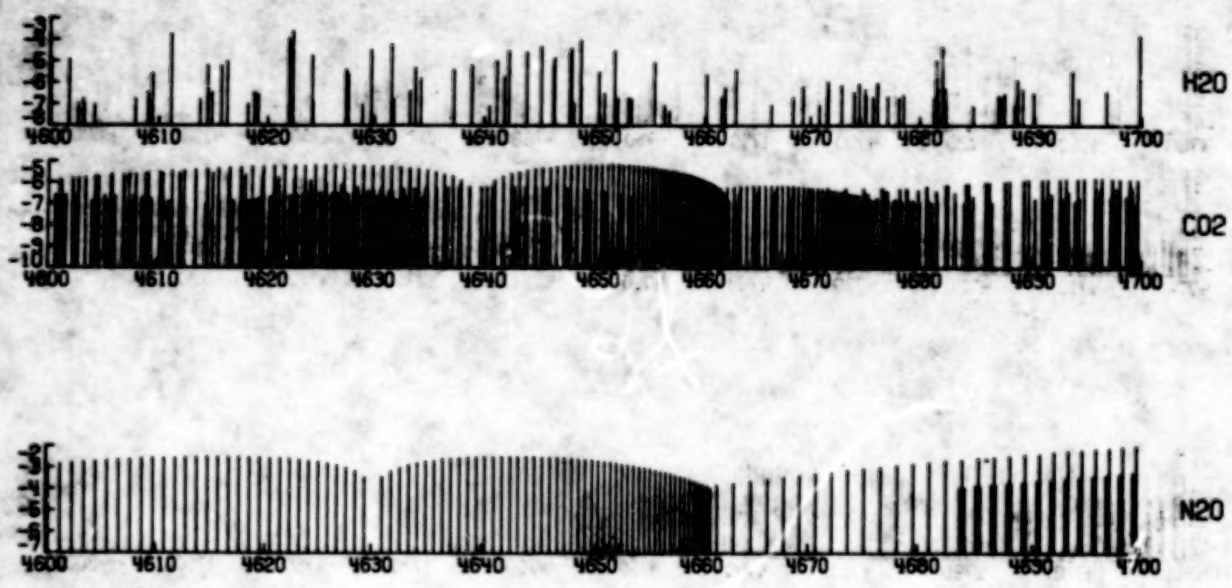
FIG.40. LINE STRENGTH VS. WAVENUMBER (4400 AND 4500 CM-1, 2.27 - 2.22 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

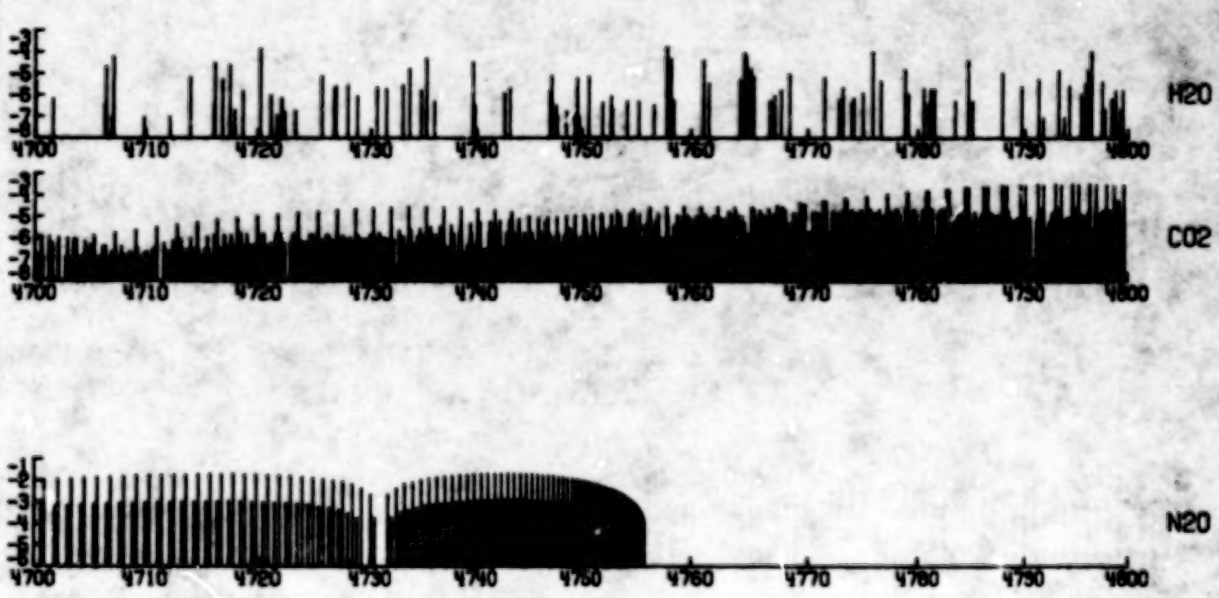
FIG.41. LINE STRENGTH VS. WAVENUMBER (4500 AND 4600 CM-1, 2.22 - 2.17 MICRON)



LOG (LINE STRENGTH • ATM-1 CM-2)

WAVENUMBER

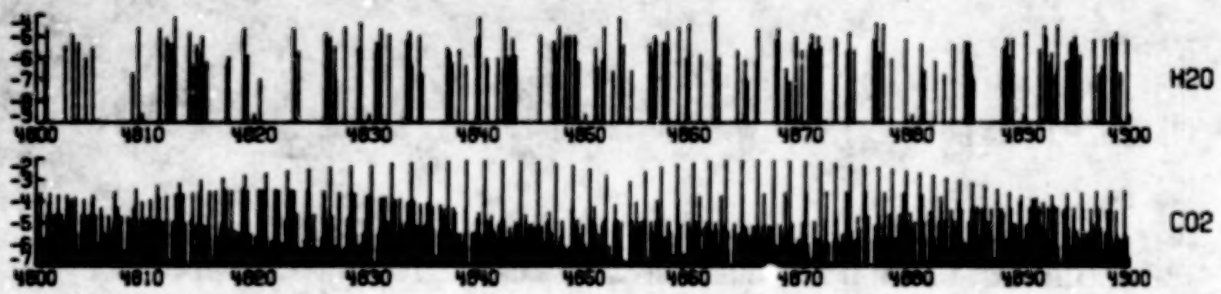
FIG.42.-LINE STRENGTH VS. WAVENUMBER (4600 AND 4700 CM-1, 2.17 - 2.12 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

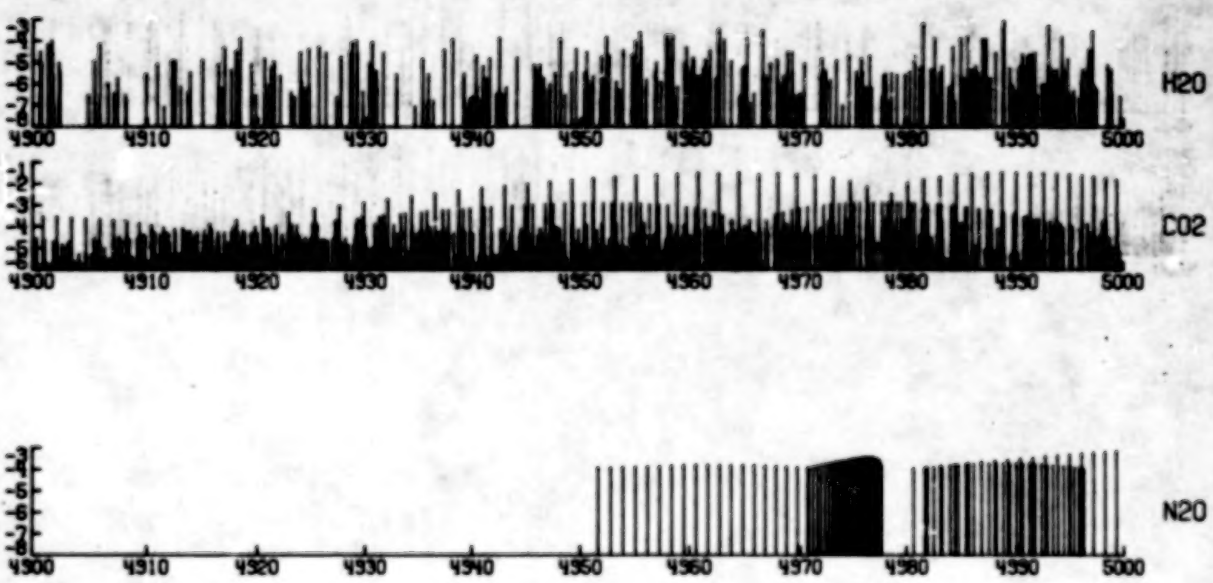
FIG.43. LINE STRENGTH VS. WAVENUMBER (4700 AND 4800 CM-1. 2.12 - 2.08 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

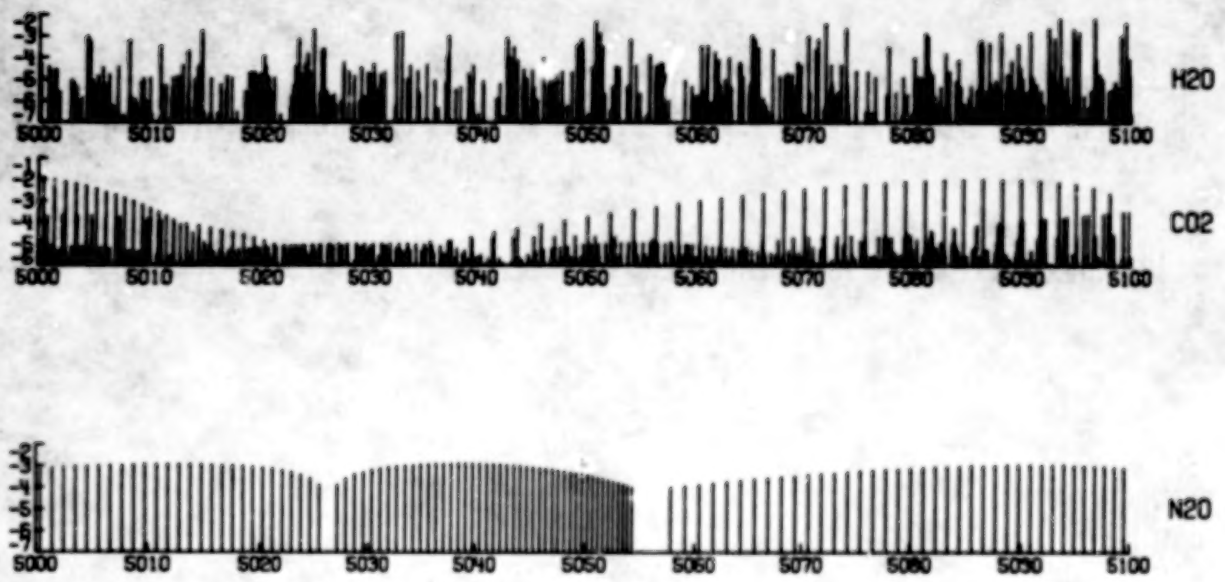
FIG.44. LINE STRENGTH VS. WAVENUMBER (4800 AND 4500 CM-1. 2.08 - 2.04 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

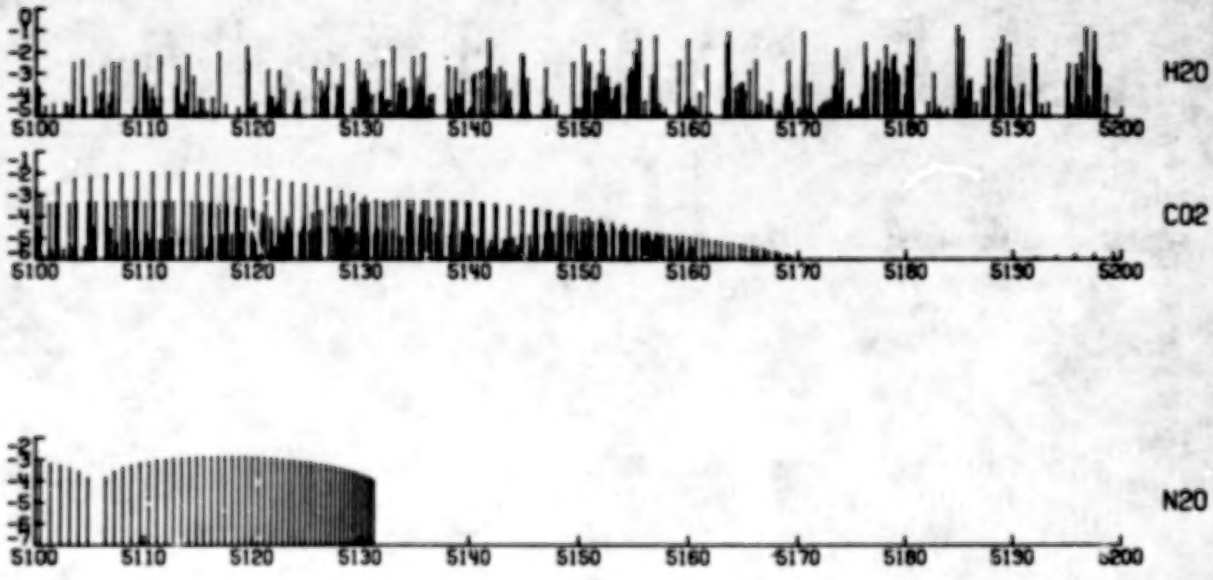
FIG.45. LINE STRENGTH VS. WAVENUMBER (4900 AND 5000 CM-1. 2.04 - 2.00 MICRON)



LOG (LINE STRENGTH , ATM-1 CM-2)

WAVENUMBER

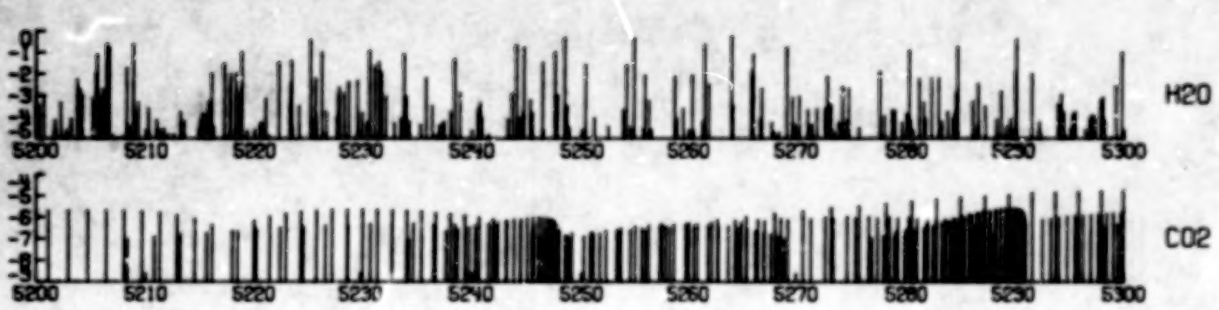
FIG.46. LINE STRENGTH VS. WAVENUMBER (5000 AND 5100 CM-1, 2.00 - 1.96 MICRON)



LOG (LINE STRENGTH , ATM-1 CM-2)

WAVENUMBER

FIG.47. LINE STRENGTH VS. WAVENUMBER (5100 AND 5200 CM-1, 1.96 - 1.92 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

FIG.48. LINE STRENGTH VS. WAVENUMBER (5200 AND 5300 CM-1, 1.92 - 1.88 MICRON)

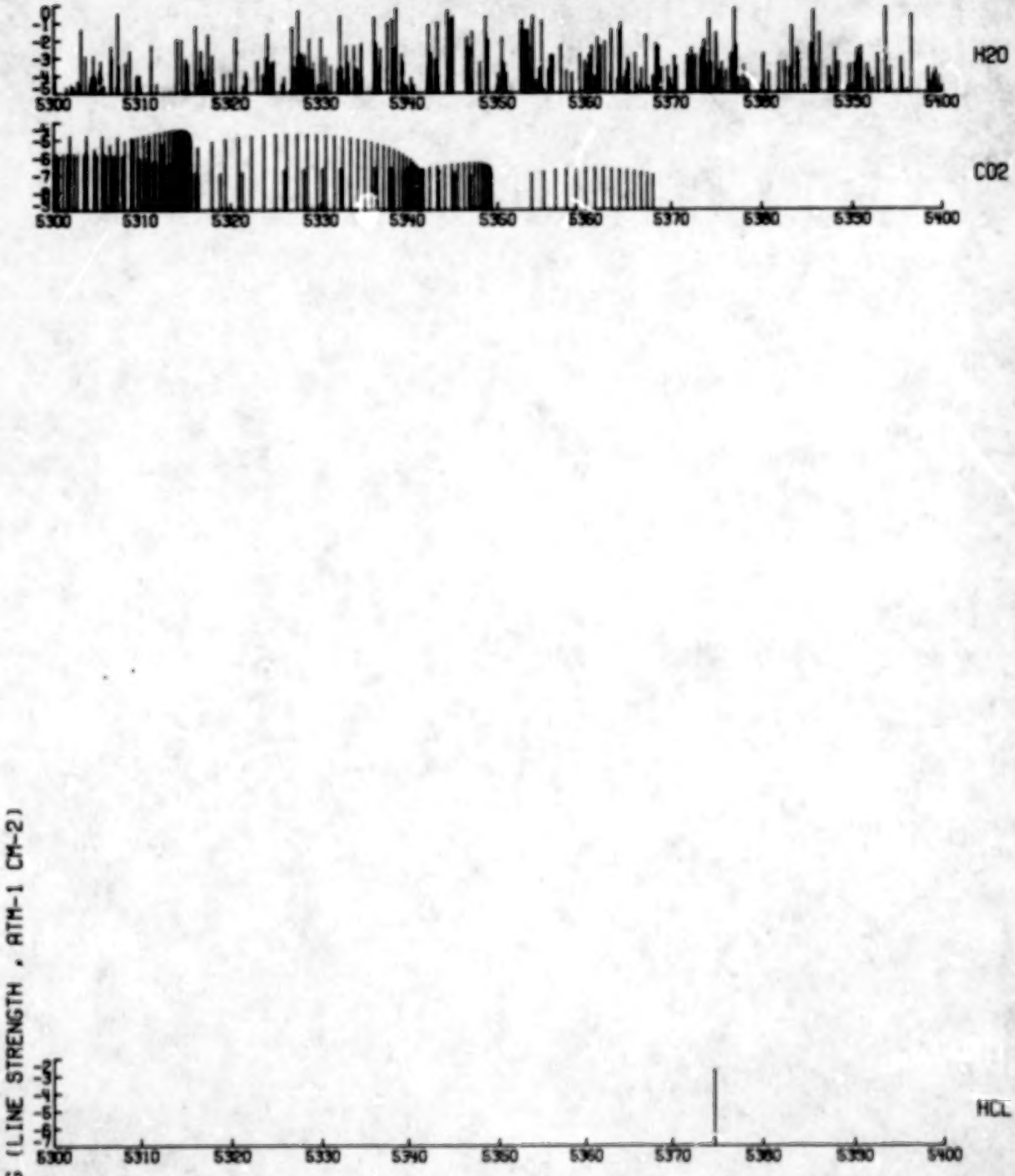
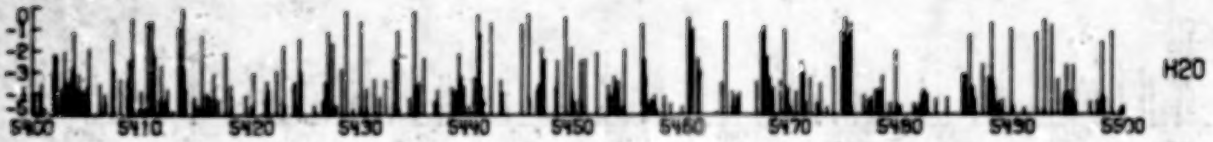


FIG.43. LINE STRENGTH VS. WAVENUMBER (5300 AND 5400 CM-1, 1.88 - 1.85 MICRON)



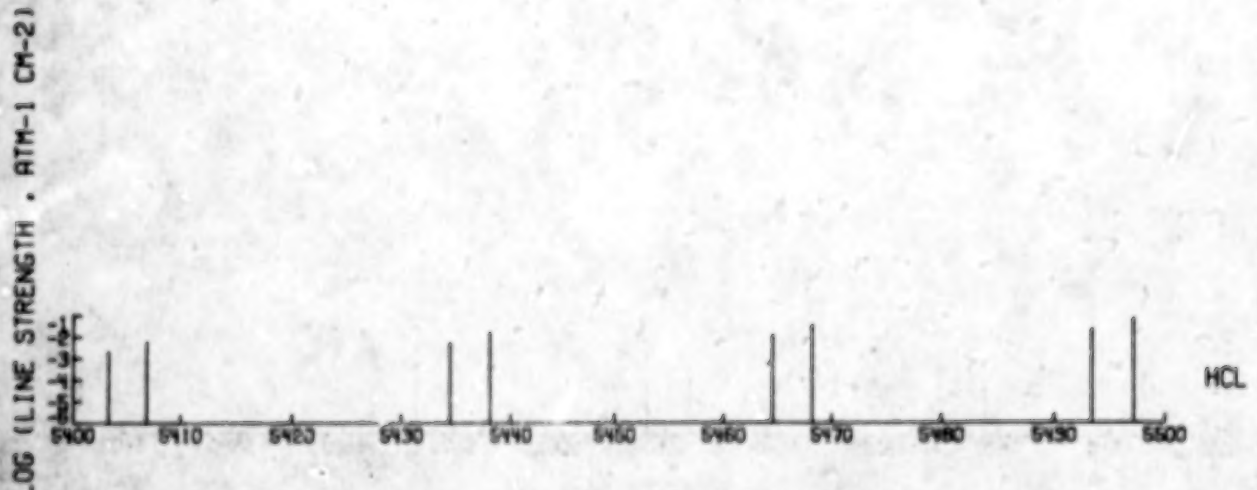


FIG-50. LINE STRENGTH VS. WAVENUMBER (5400 AND 5600 CM-1, 1.85 - 1.81 MICRON)

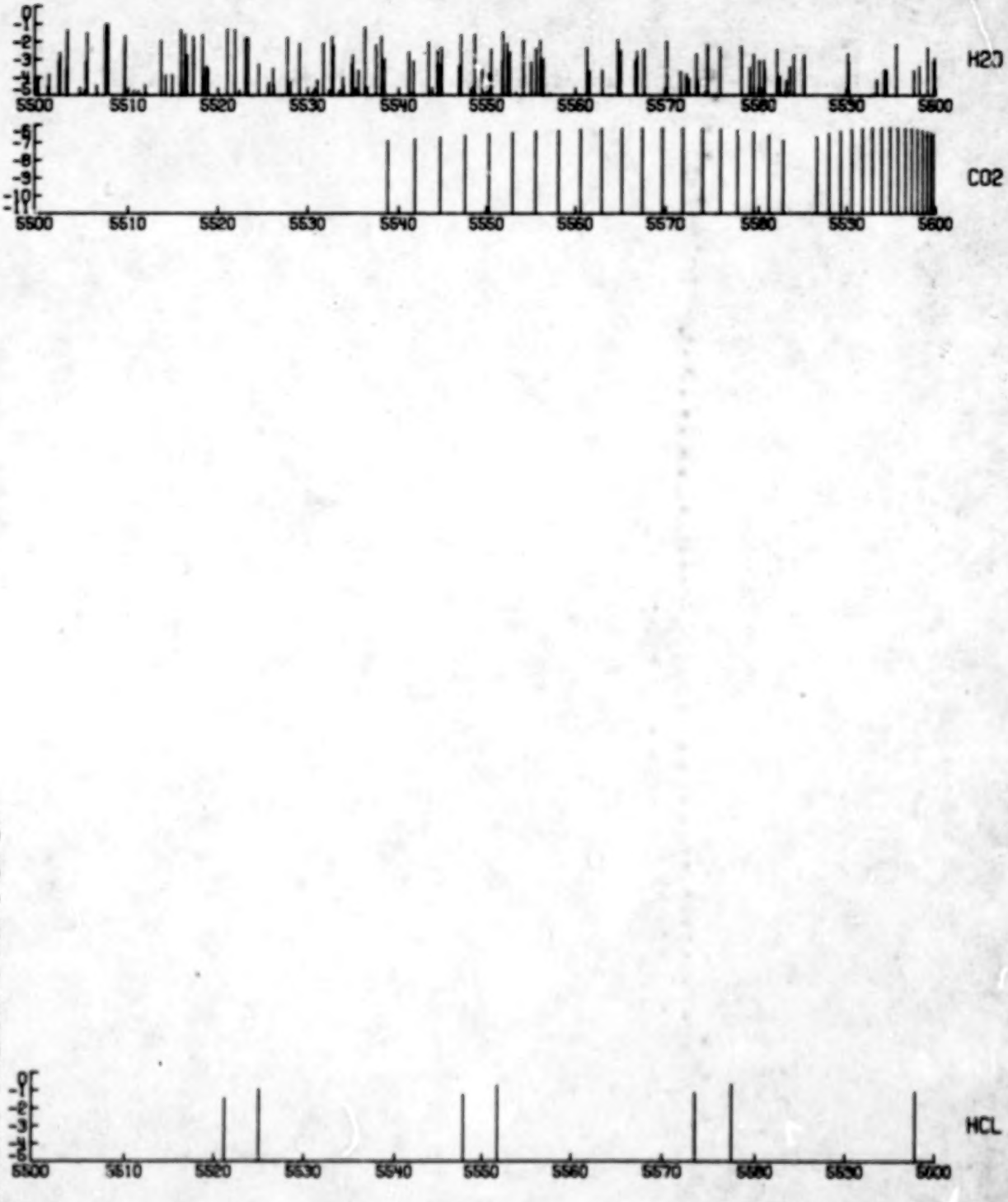


FIG.51. LINE STRENGTH VS. WAVENUMBER (5500 AND 5600 CM-1, 1.81 - 1.78 MICRON)

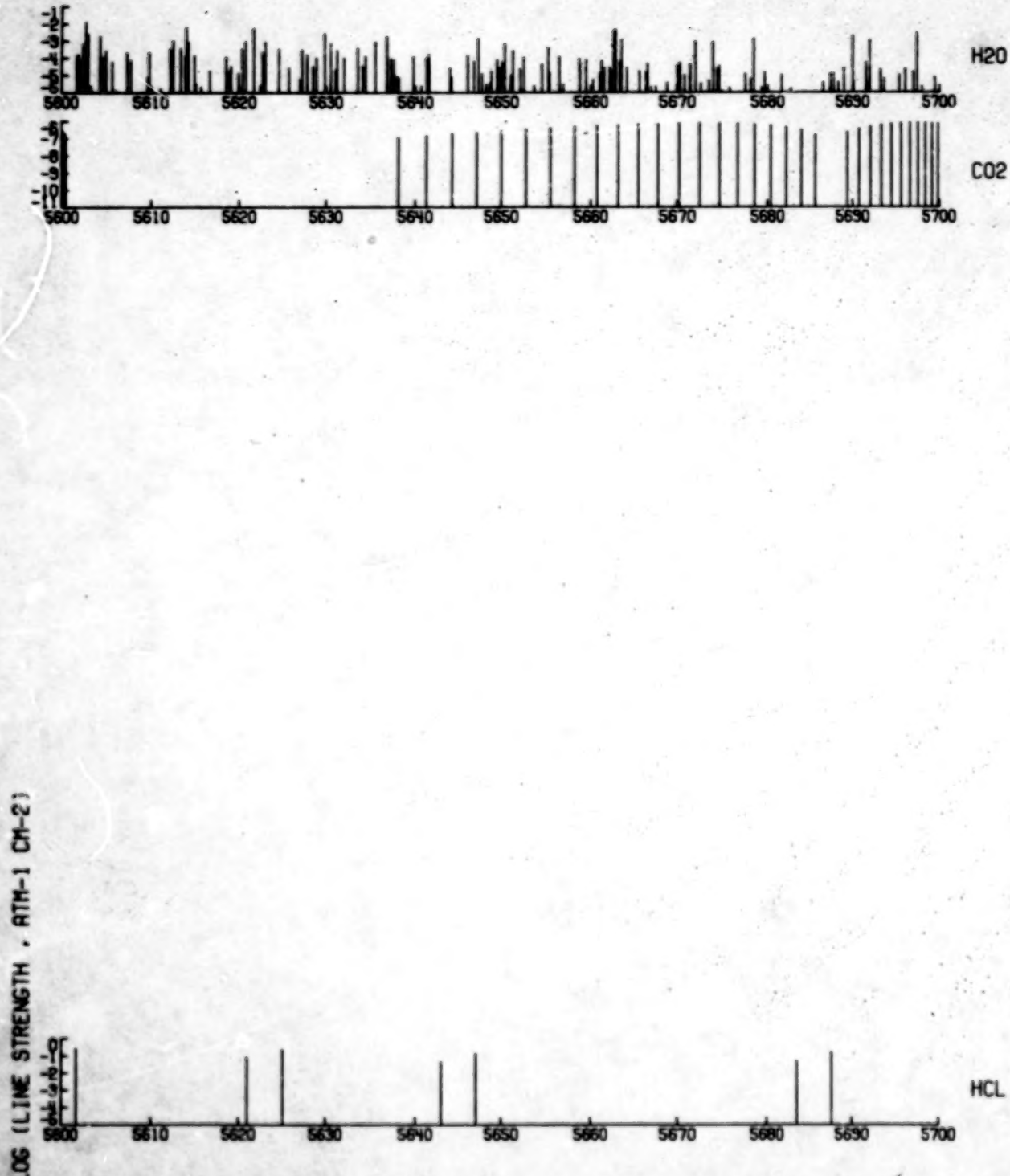


FIG-52. LINE STRENGTH VS. WAVENUMBER (5600 AND 5700 CM-1, 1.78 - 1.75 MICRON)

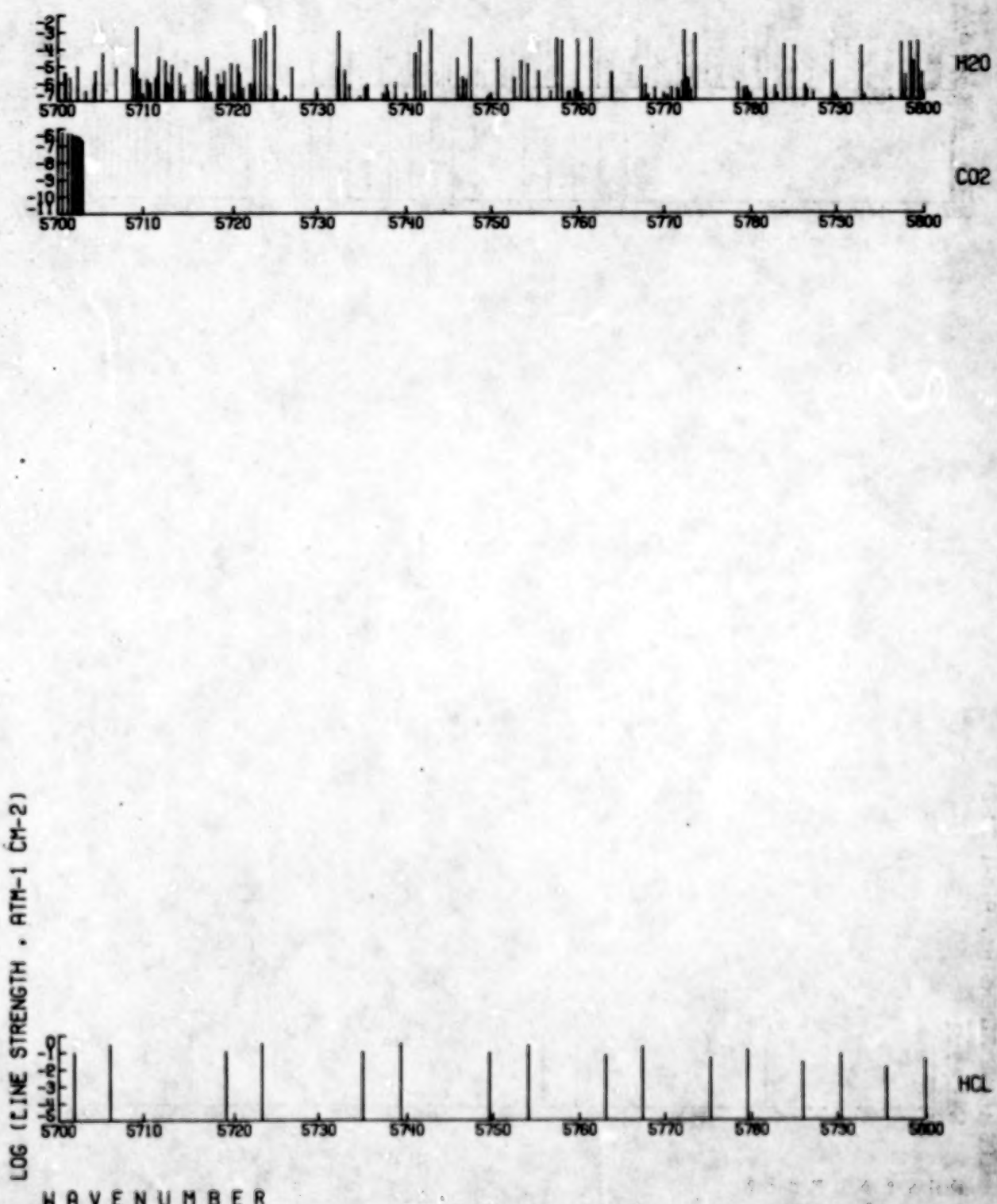


FIG.53. LINE STRENGTH VS. WAVENUMBER (5700 AND 5800 CM-1, 1.75 - 1.72 MICRON)

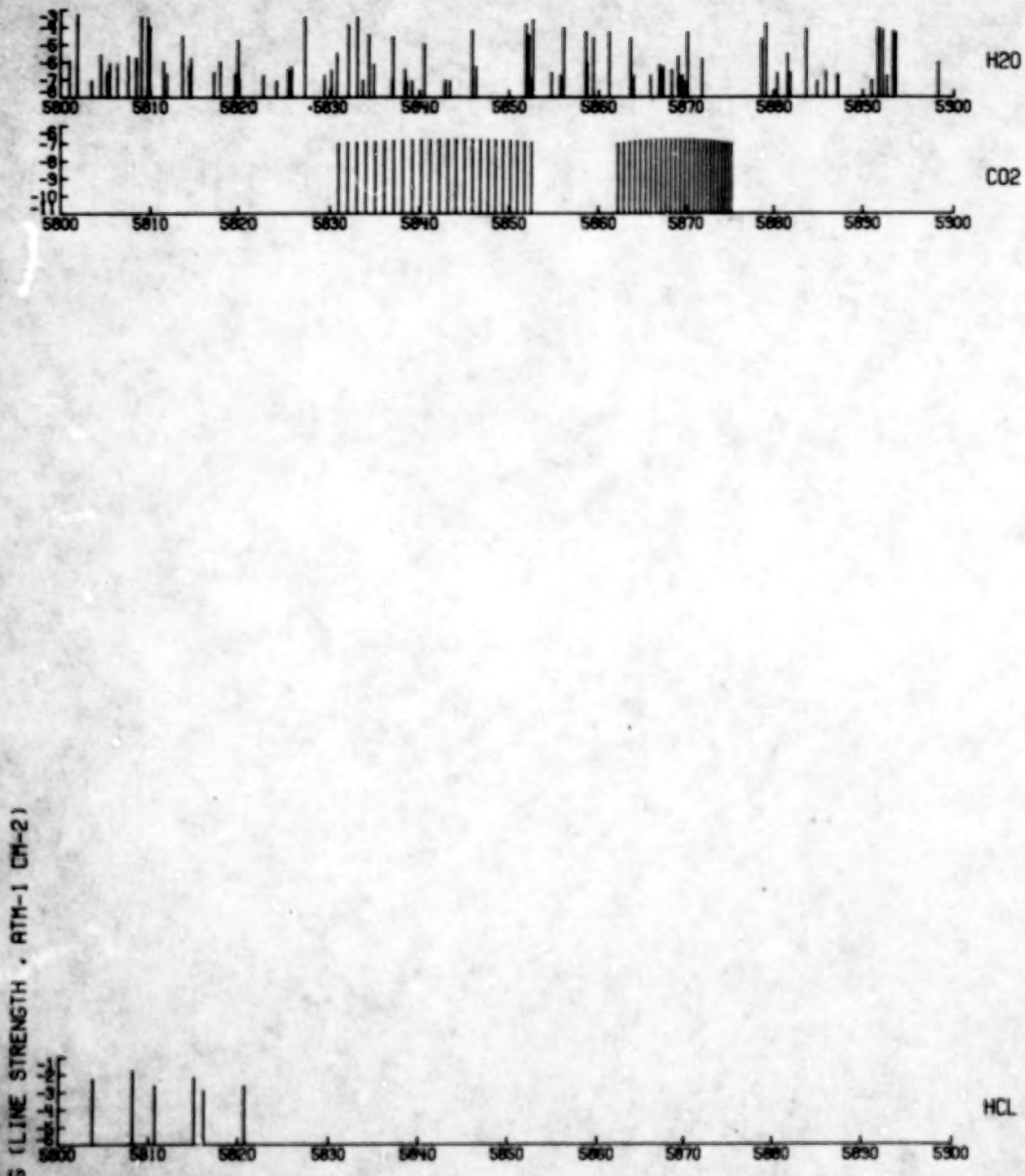
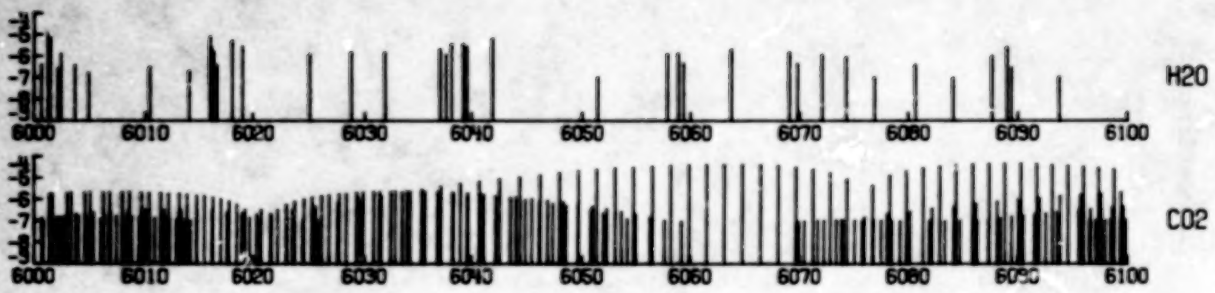


FIG.54. LINE STRENGTH VS. WAVENUMBER (5800 AND 5900 CM-1, 1.72 - 1.69 MICRON)

LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

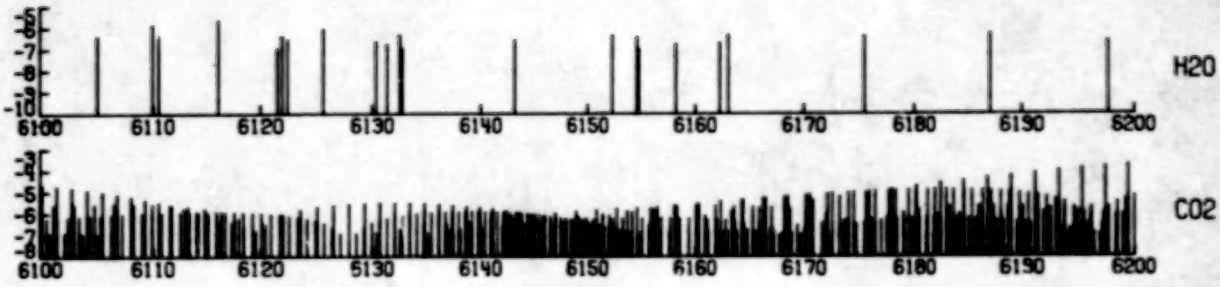
FIG.55. LINE STRENGTH VS. WAVENUMBER (5900 AND 6000 CM-1. 1.69 - 1.66 MICRON)



LOG (LINE STRENGTH , ATM-1 CM-2)

WAVENUMBER

FIG.56. LINE STRENGTH VS. WAVENUMBER (6000 AND 6100 CM-1. 1.66 - 1.63 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

FIG.57. LINE STRENGTH VS. WAVENUMBER (6100 AND 6200 CM-1, 1.63 - 1.61 MICRON)

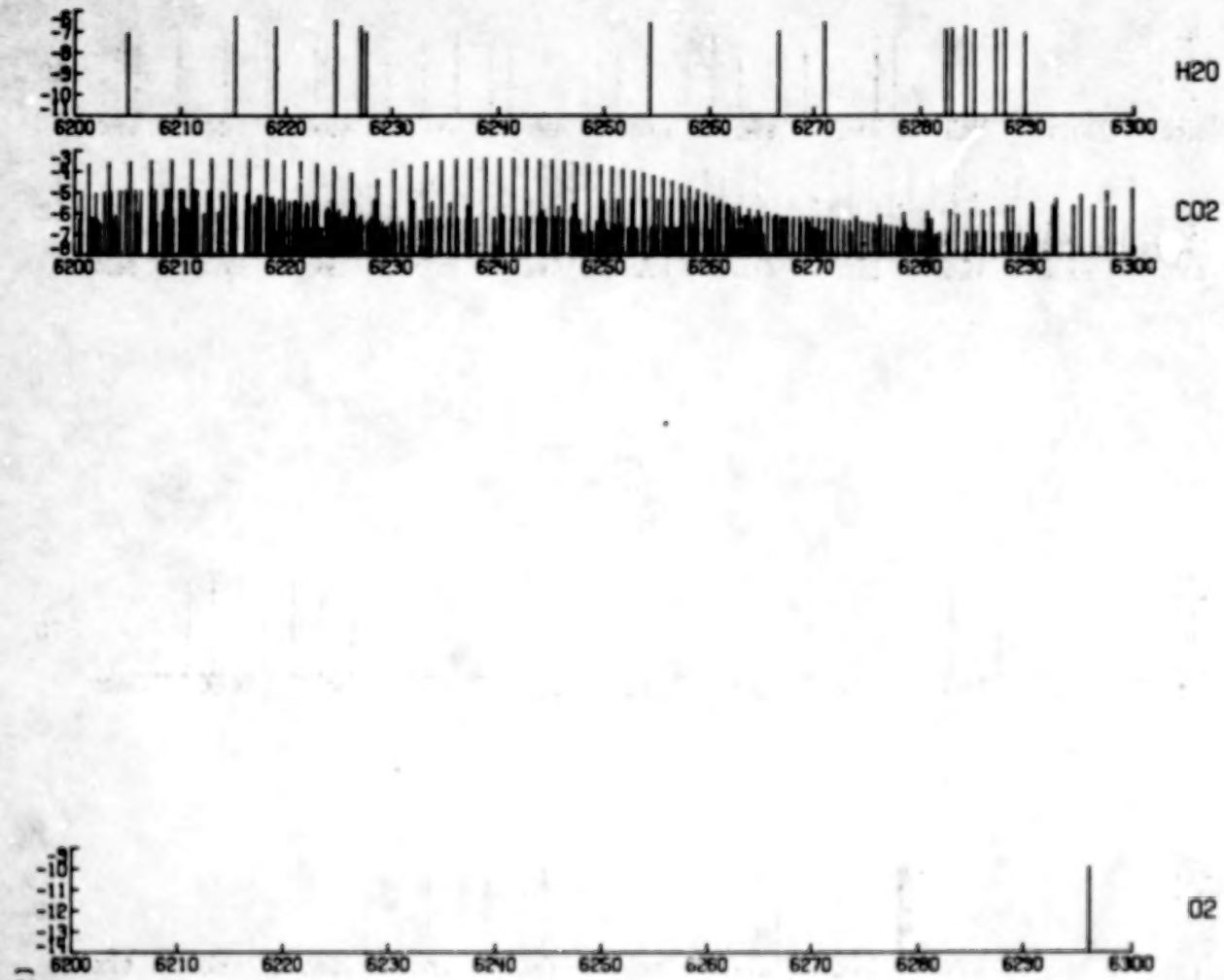


FIG.58. LINE STRENGTH VS. WAVENUMBER (6200 AND 6300 CM-1, 1.61 - 1.58 MICRON)

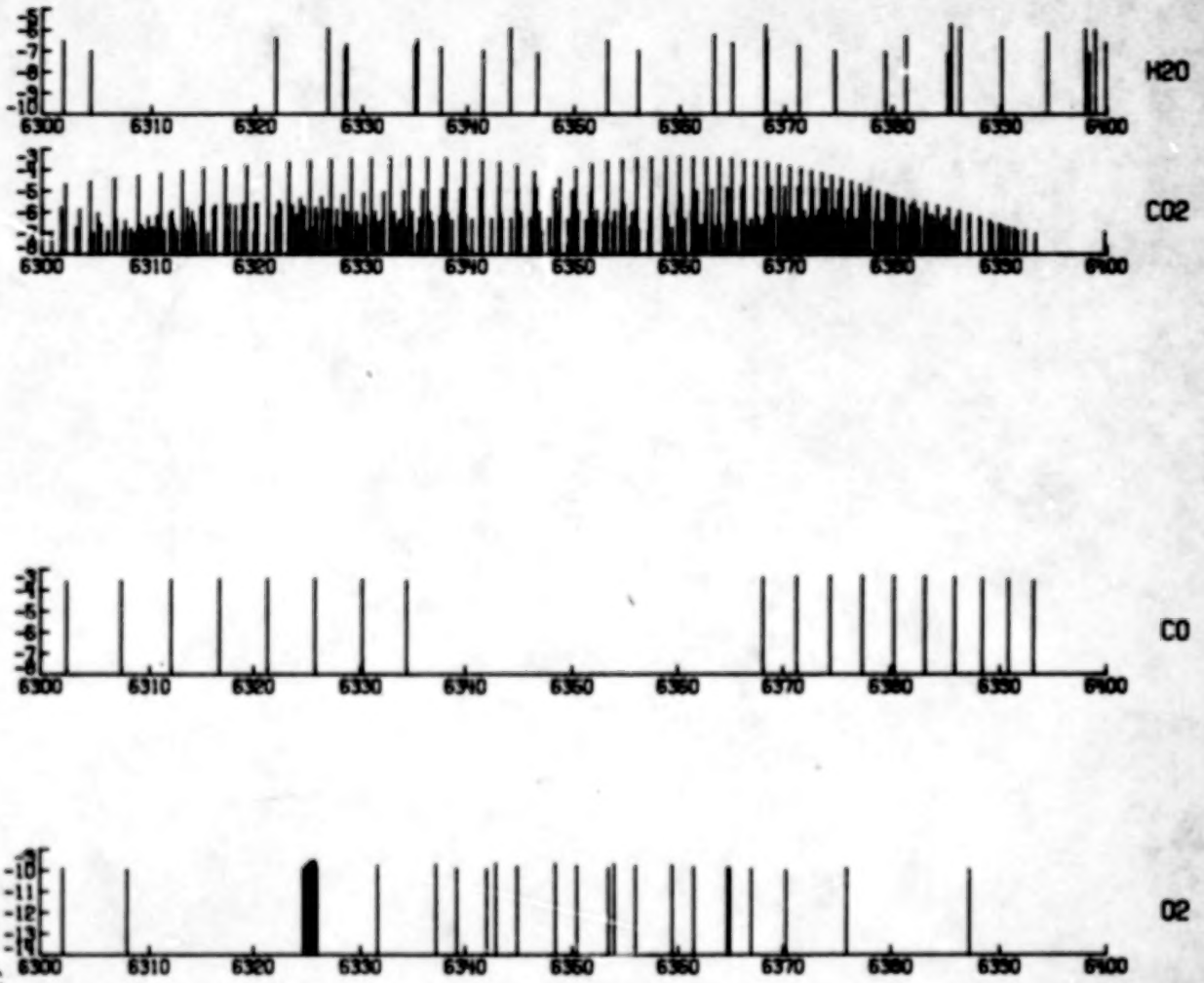
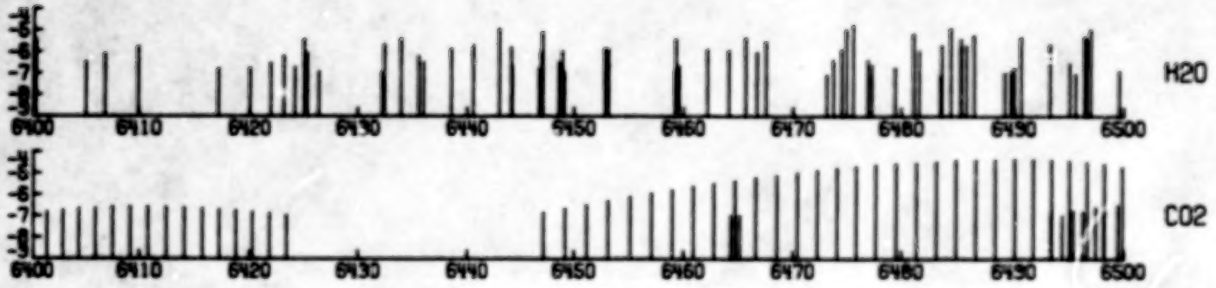


FIG-89. LINE STRENGTH VS. WAVENUMBER (6300 AND 6400 CM-1. 1.58 - 1.56 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

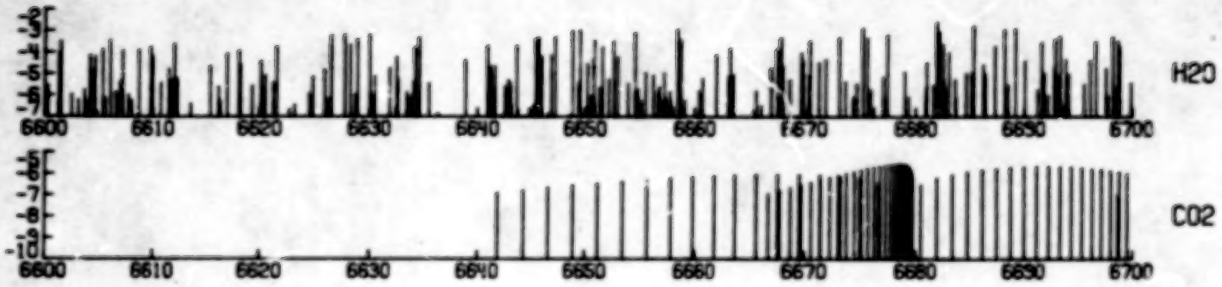
WAVENUMBER

FIG.80. LINE STRENGTH VS. WAVENUMBER (6400 AND 6500 CM-1. 1.56 - 1.53 MICRON)

LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

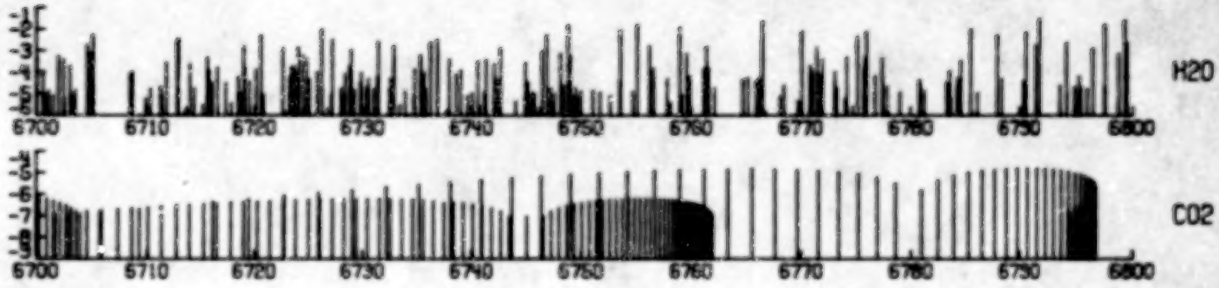
FIG.61. LINE STRENGTH VS. WAVENUMBER (6500 AND 6600 CM-1. 1.53 - 1.51 MICRON)



LOG (LINE STRENGTH • ATM-1 CM-2)

WAVENUMBER

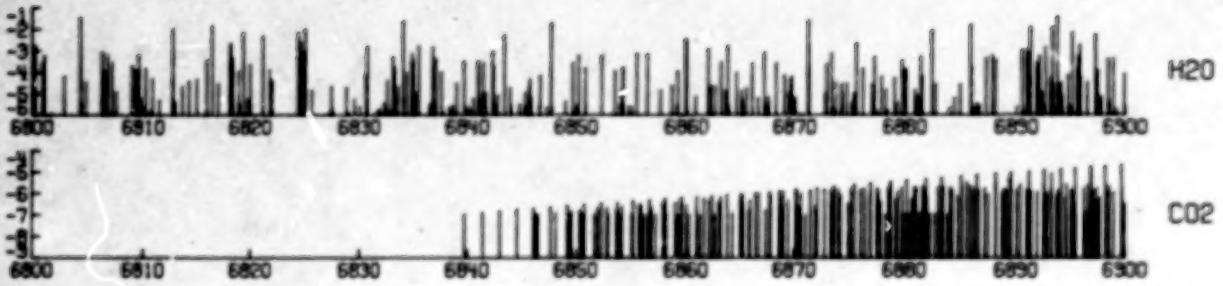
FIG.62. LINE STRENGTH VS. WAVENUMBER (6600 AND 6700 CM-1, 1.51 - 1.49 MICRON)



LOG (LINE STRENGTH , ATM-1 CM-2)

WAVENUMBER

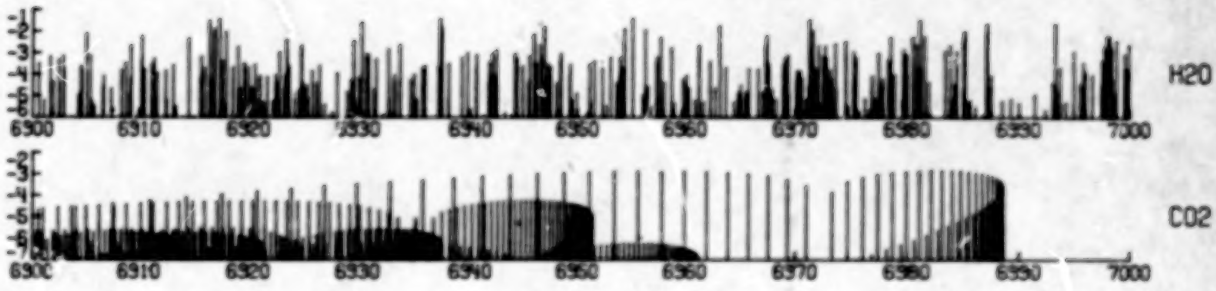
FIG.63. LINE STRENGTH VS. WAVENUMBER (6700 AND 6800 CM-1, 1.49 - 1.47 MICRON)



LOG (LINE STRENGTH , ATM-1 CM-2)

WAVENUMBER

FIG.84. LINE STRENGTH VS. WAVENUMBER (6800 AND 6900 CM-1, 1.47 - 1.44 MICRON)



LOG (LINE STRENGTH . ATM-1 CM-2)

WAVENUMBER

FIG.65. LINE STRENGTH VS. WAVENUMBER (6900 AND 7000 CM-1. 1.44 - 1.42 MICRON)

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16. Abstract

This atlas of infrared absorption lines contains absorption line parameters (line strength vs. wavenumber) from 500 to 7000 cm^{-1} for 15 gases: H_2O, CO_2, O_3, N_2O, CO, CH_4, O_2, SO_2, NO, NO_2, NH_3, HCl, HF, HNO_3 and CH_3Cl.

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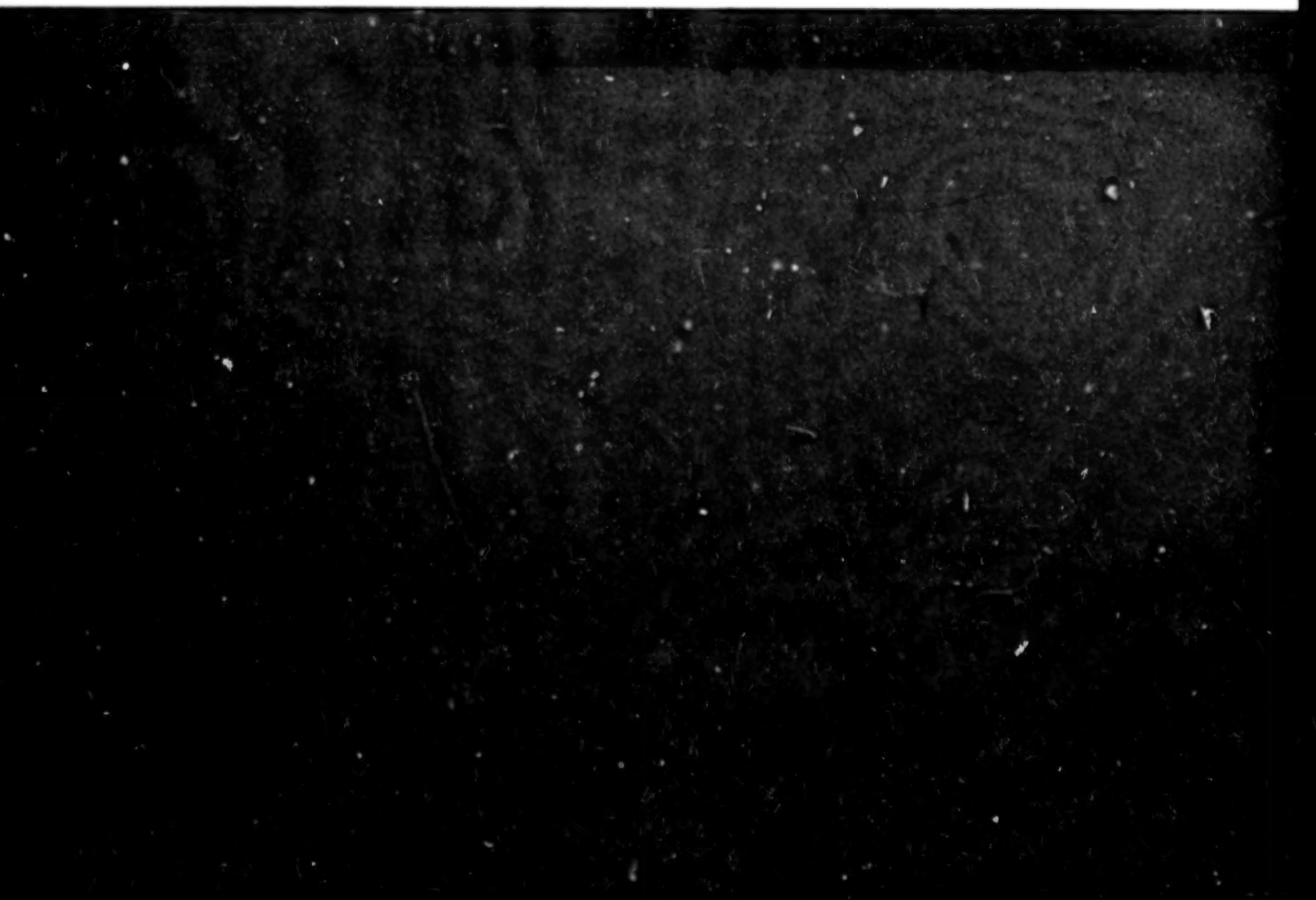

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